Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.



a SB 388

ON STANCE OF THE PROPERTY OF T

NORTH CAROLINA STATE COLLEGE

SCHOOL OF AGRICULTURE RALEIGH, N. C.

May 8, 1961

Department of Horticulture

Dr. D. H. Scott Crops Research Division, ARS Beltsville, Maryland

Dear Dr. Scott:

Herewith is a copy of the report on Muscadine Grape Breeding. Now that it is put together, I am disappointed in it. It is too long, and yet it contains little information. However, it was only intended as an outline of the work done. The Tables are a bit confusing perhaps but the long ones are lists of crosses and of selections that are needed somewhere.

There are five typed copies with photos which I am distributing as follows: D. H. Scott, N. H. Loomis, F. D. Cochran, Underwood (office copy), myself. If more are to be typed, perhaps there will be some changes suggested.

I am also sending you a revised summary of grape material on hand and a classification of selections. These are more easily comprehended than the Tables in the report. I am not sure that all the totals agree.

Sincerely,

C. F. Williams Research Professor

CFW/csd

stone To Now that it is you besetter, I am of surprished in the to lower to the you love.

And you that it is you besetter, I am of surprished in the too lower and you it is not it contains likely interest. It was only interest as an omiliar of the war done, The Tables are a bit morfied-c art and rollows: D. W. Soott, D. M. Loostr, J. D. Cochran, Hasterwood (attitue coup), arrest. If more are to on troad, perhaps there will be raise changes somewhed. tohn the Tablet is the transport. The most over that all the total acres. The state of the

Grape - Raleigh, N. C. - 4/12/61

		source of	stock			
Selections	Original	McCullers		4x	Total	
Possible release Test Very good Good Breeding stock Total	5 5	6 11 10 6 33	1 13 32 22 12 80	3 1 6 8 18	7 27 43 28 31 136	2 early
Seedlings, Muscadine Diploid Selected once Not selected Nursery rows Seed 1960 Total	10 10 113 133	7 0 approxi 2049	imately seed (ge	rmina	tion good	1)
Polyploid Original colchiploids Radiated Higgins 4x selections Seedlings in vineyard Seedlings in nursery 3x and treated Total	1	8 4 4				
Species Hybridization Original 2n hybrids Colchiploid selections 6-15 and 6-16 progeny 4x from 4x crosses Colchiploids of 1959 Colchiploids of 1960 3x and treated Total	1 34 2 15 4	5 4 6 7				
1960 seed	40	8 potted				

	E		Internal in	Colections Selections Test Very good
				Good Preding stock
				Tobal Saedlings, buccading Diploid
				Polyploid Original colonicloids Hadisted Higgins Ax Helections Seedlings in vineyard Seedlings in nursery Hadisted Total
			6.29 25, 25, 25, 154, 46, 46,	Openies Hybridisation Original En sybride Colonirloid selections O-15 and O-16 progeny Ax from Ax crosses Ax from Ax crosses Coloniploids of 1950 Coloniploids of 1950 Fatad

I	II	III	IV	V	VI
Release	Test	Very good	Good	Stock	Diseased
27-262 29-193 9-305 60-60 59-32	11-173 11-186 27-128 29-32 29-115** 29-156*	5-63 9-1 9-308 15-161 15-165 17-197	ches one was	B6-19 V21 R15 B2 G 52 25-8-26 37-10-1	77 7776
	33-13 33-98* 44-15* 57-56** 15-229 Early	20-30 27-229 27-354 29-47 33-106 58-89 F		20-119 28-193 28-222 44-47 46-15 F 64-53	11-178 17-55 33-9 56-98
	77-21 77-61 81-41 85-172 86-12 88-9 88-102 104-8 108-169 109-21 109-157 110-34 4x C 72** 4x C 98** 4x 131-12**	77-51 77-108 77-194 77-123 F 80-74 80-114 80-153 80-169 F 81-16 83-52 84-56 84-92 85-47 85-122 86-156 87-56 F 87-102 89-12 89-40 89-52 92-18 93-26 101-12 103-35 106-5 109-34 109-82	73-48 74-103 79-9 80-68 F 84-82 88-67 88-120 100-8 100-23 100-29 F 100-40 101-18 108-74 110-93 111-47 111-108 111-113 112-65 115-146 F 115-259 116-189 136-9 4x C 47 4x C 62 4x C 79	DS 56 DS 127 72-76 72-109 73-84 74-110 85-90 94-4 95-162 95-167 101-35 116-272	
	4x 226-11**	109-120 109-174 109-186 116-68 136-22 4x C 57	4x C 90 4x C 102 4x C 105		

F= female, all others harmaphrodite.

-					
			5 63		
			1-0		
				28-65	
	27 cm 2 1 mm?				25-55
	Tank Tank C				
	9[[m]]			33-33	
	28-193		27-229	33-38¢	
	Photoli			57-5644	
			33.06	115-120 Early	
				Auto Barasti	
				Par 2003	
				777-22	
		13-18	15-66	19-77	
	DY LOS		305-25	IA-IB	
	30,00		761-124		
				86-12	
		3 mm 3 3	74-08	0.488	
			771-08	207-89	
		081-38	80-153	10%-8	
		1.00.1	80-159 F	PD.C-80.I	
	95-162		01-18	981-501	
			CA-ER	103-23	
		0.1-001	32-48	1208-164	
			84-92	75-071	
		110-93			
		12 For L. L. L.	997-98		
		807-111	87456 8		
			50,0-73		
		112-65	85-15		
			89-40		
		115-259	89-52		
		116-189	92-28		
			101-12		
			303-35	6-121-121 x	
			3,06+5		
			109-82		
			1.09-1.20		
			72,1-601		
				wall-925 x	
			116-68		
			4x 6 57		

By plane de of charpenton

- I. Increase for release to nurseries for propagation and to cooperators for testing also Willard and Jackson Springs.
- II. Increase for testing at Clayton, Willard, Jackson Springs Coop. Miss. Sta., Miss. Loomis, Georgia Sta. Coop. Barnes, Onslow Winery, Ownes (Georgia)
- III. Two each at Clayton (and as many as possible at Willard and Sandhills)
 Coop. Miss., Loomis, Georgia (Owens)
- IV. Save some may move up to III or to V and VI
- V. Be sure to save the 5 original and the 6 from McCullers.

Some of I, II, are already with Loomis and Georgia and other Stations.

. Oleydo nd ac mady as mostible at Willerd and mandhille) . S., Lo Georgia (Owqua)

IV bus V of to III of go event yan such

Be sure to save the 5 original and the 6 from McCull and

Some of I, II, III, are stready with Loumis and Georgia and other Startons.

MUSCADINE GRAPE BREEDING

1945-1961

C. F. Williams

North Carolina Agricultural Experiment Station

In cooperation with

Crops Research Division, U. S. Department of Agriculture

LOST-SIST.

TABLE OF CONTENTS.

List	of Tables	
List	of Figures	
List	of Photographs	
Forew	vard	1
I.	Diploid Breeding	
	Introduction	4
	Inheritance Studies	5
	Progenies From Self-pollination	13
	Selections	15
II.	Polyploid Breeding	
	Colchiploids	17
	Tetraploids	20
	Triploids	23
	Conclusions	24
III.	Hybridization With American and European Bunch Grapes	
	Review	25
	Progenies of NC 6-15 and NC 6-16	26
	Present Program of Species-Hybridization	
	Autopolyploids	29
	Alloployploids	30
	Triploids and Hexaploids	31
	Conclusions	33
Liter	eature cited	35
Table	es 1 to 24	
Figur	res 1 to 4	
Photo	ographs 1 to 19	

13

15

C'I

00

are on been 75-3 Die

.

) I MET

.

TABLES

Diploid Breeding

- 1. New varieties originated in the muscadine grape breeding program.
- 2. Muscadine grape crosses (diploid).
- 3. Summary of average ratings of progenies in muscadine grape crosses.
 - A. Vigor of all seedlings, rated 1-10.
 - B. Resistance to black rot of all seedlings, rated 1-10.
 - C. Berry size of perfect-flowered seedlings, av. wt. in grams.
 - D. Sugar of perfect-flowered seedlings, percent total soluble solids.
- 4. Summary of average ratings of progenies in several muscadine grape crosses.
- 5. Summary of average ratings of progenies in several muscadine grape crosses.
- 6. Differences in average berry size of seedlings in relation to their sex and seed parent in progenies of grape crosses.
- 7. Differences in average berry size of seedlings in relation to their sex and pollen parent in progenies of grape crosses.
- 8. General characteristics of progenies of different parents.
- 9. Sources of various characteristics.
- 10. North Carolina selections sent to southeastern experiment stations for testing.
- 11. Yields of muscadine varieties and selections at the Central Research Station, Clayton, N. C.

o and

- of average ratings of progenies in muscading amaps orases.
 Vigor of all sendlings, rated .
 - . estatence to bleck rot of all seedlings, rated -1 .
 - erry 'se of perfect-flowered soedlings, ... wt. in ...
- . ingst of perfect-flowered seedlings, percent total soluble solids.

 of everage ratings of propenies in several mascadine grape
 - of average rabings of properties in several muscadine grape
- and reed parent in progenies of ampercases,
- '. Differences in average berry size of seedlings in relation to their sex and pollen percent is progenies of grape crosses.
 - eral characteristics of progenies of different par .

4

· lections sent to southeastern experiment station for

Tables continued

Polyploid breeding

- 12. Growth and productivity of colchiploid vines and comparisons of berry size and pollen with diploid vines.
- 13. Distribution of propagations of 4x colchiploid vines.
- 14. Berry measurements of diploid and colchiploid vines of different selections; 1954.
- 15. Germination, survival and growth of tetraploid and diploid seedlings (1954 seed).
- 16. Crosses with tetraploid muscadine grapes.

Species hybridization

- 17. Hybridization of Vitis rotundifolia with other species at the North Carolina Experiment Station, Raleigh, N. C. between 1910 and 1925.
- 18. Hybridization of Vitis rotundifolia. F2 generation.
- 19. Summary of diploid crosses with NC 6-15 and NC 6-16.
- 20. Summary of tetraploid crosses with NC 6-15 and NC 6-16.
- 21. Tetraploid species crosses.
- 22. Diploid species crosses and results of colchicine treatments.
- 23. Species crosses to obtain triploids and results of colchicine treatments.

Polyploid breeding

tivity of colchiploid vines and comparisons of berry

niolgic diw mallog

and the second s

selections; 1954.

. -----

v - 3

4

Germination, survival and growth of tetraploid and diploid seedings

Grosses with tewnsploid muscadine grades.

opecies hybridization

disation of Vitis retundifolia with other species at the North

. Eyeridization of Vitis retradifelie. Fy generation.

. sary of diploid crosses with NC (- and N 6-16.

. - 28. I die zammen ninterpretat to

es and regul s of colonidine trostments.

to obtain triploids and results of colchicine treat-

Tables continued

- 24. List of grape material at the North Carolina Experiment Station, January 1, 1961.
 - I. Muscadine
 - 1. Overhead arbor
 - A. Varieties
 - B. Older numbered selections
 - C. Selections from McCullers Research Station

Best

Very good

Good

Stock

Probable discard

- 2. Vertical trellis
 - A. Selections

Best

Very good

Good

Stock

- B. Seedlings planted
- C. Seedlings in nursery rows
- D. Seed of 1960 crosses sown Feburary 6, 1961
- E. Tetraploid Selections
- II. Species hybridization
 - A. Parental material
 - B. Species-hybrid selections
 - C. Species-hybrid seedlings (not colchicine treated)
 - D. Species-hybrid seedlings (colchicine treated)
 - E. Triploid species-hybrids
 - F. Crosses of 1960, seed planted February 6, 1961

anfi itus .a

. Mder membered selections

. Selections from the lessanch Station

Best

.

•

. .

Very good

6000

Probable discard

.

the state of the s

•

-uners else se

the second of the second

telling and the company of the compa

. Vertical Leglin

- - - · · ·

Figures

- l. Comparison of size of berry in relation to the number of seeds per berry for 2n and 4x vines of selection NC 11-178.
- 2. Comparison of size of berry in relation to the number of seeds per berry for 2n and 4x vines of selection NC 20-30.
- 3. Comparison of size of berry in relation to the number of seeds per berry for 2n and 4x vines of selection M7.
- 4. Comparison of size of berry in relation to the number of seeds per berry for 2n and 4x vines of selection MIO.

Photographs

- 1. NC lll-108 [Latham x (Lucida x Burgaw)] Light fruited selection with large clusters of persistent berries. Clusters with desirable long stems.
- 2. NC 94-4 [(Thomas x Burgaw) x (Scuppernong x Tarheel)] Dark fruited selection with large compact clusters. Vine is very productive, but the fruit is rather acid.
- 3. NC 60-60 [25-8-26 x (Topsail x Tarheel)] Light fruited selection, with large fine flavored fruit.
- 4. NC 59-32 [Lucida x (Topsail x Tarheel)] Light fruited selection with large very attractive berries.
- 5. NC 89-48 [(Scuppernong x Tarheel) x (Topsail x Burgaw)] Very productive, light fruited selection. Berries attractive and fine flavored.
- 6. NC 93-26 [(Latham x Burgaw) x (Thomas x Tarheel)] Very productive, black fruited selection. Clusters too compact and short stemed for easy harvesting. Sweet and good flavored.
- 7. Creek (4x) Original colchiploid vine showing very good vigor, equal to that of the diploid form. Canes are of the past season, unpruned.

rison of size of barry in relation to the number of seeds per nd 4x vines of selection NG 11-178.

berry for 2n and 4x wires of solication Wo the number of seeds per

n of size of berry in relation to the number of seeds per and . x vines of selection

omp ig of size of berry in relation to the number of seeds per for 2nd and 4x sines of selection .

Photographs

Clil-108 [lat . x (losida x Burgaw)] Light fruited selection with

Targe clusters of persistent ermin. Clusters with desirable long

.

Thomas raw) x (Scuppernong x Tarheel)] Dark fruited on with large compan clusters. Vine is very productive, but it is rather act.

diw noiteeles beringt thail [(Isadae" x 1 ss 7

(Thomas x Parheel) Wer productive, black

- 8. Dulcet (4x) Original colchiploid showing severe dwarfing. Vine is the same age as Creek vine in Figure 7. Photo taken from shorter distance and the vine appears proportionally larger than it is in comparison with Creek. Canes show several years of growth.
- 9. Berries of 2n (left), and 4x (right) NC 20-30, showing difference in size.
- 10. Two year old seedlings of 4x (left) and 2n (right). Note the short compact root systems and short internodes of the 4x seedlings.
- 11. One year old seedlings of 2n crosses (left) and 4x crosses (right).
- 12. Two year old seedling of 4x crosses (left) and 2n crosses (right).
- 13. NC 6-15 (2n), many of the canes on this vine were winter injured.
- 14. NC 615-11 (2n). Seedling from open pollination of NC 6-15 (probably by V. rotundifolia). This seedling is perfect-flowered, fertile and has a relatively large flower cluster.
- 15. Row of colchicine treated species-hybrids. Cross of 1958, treated 1959, photo September, 1960.
- 16. Species-hybrids treated with colchicine.
- 17. NC 226-11 (4x) (Golden Muscat x NC 60-60). Cluster on colchicine treated species-hybrid, first year from seed. Cluster of 32 berries, averaging 3.8 grams each, 22.5% total soluble solids, excellent flavor.
- 18. Picking frame for harvesting grapes from overhead arbor. Fruit can also be placed directly into containers set on frame.
- 19. Picking frame for harvesting. Berries can be graded and packed as they roll out.

appears proportionally larger than it is comparison

est of 2n (left), and 4x (right) NO (december in the car old seed) as of 4x (left) and 2n (right), Note the short compact root systems and short internades of the 4x seedlings.

rear old seedling of Ax mosses (left) and 2n crosses in the

- (2n) many of the cenes on this vine were winter . . .

15-11 (2n). Seedling from open pollinetion of NC 6-15 probably by V. rotundifolia). This seedling is perfect-flowered, fertilo and has a relatively large Tower cluster.

. Tow of solchicine treated ectss-hyprids. Gross of 1978, tranted T., september, 1960.

· The state of the

the harmon's the

3

. . .

.

. 11

species but first resultron seed. Luster of 32 berries,



MUSCADINE GRAPE BREEDING

C. F. Williams

FOREWARD

Three important achievements have resulted from the grape breeding program; (1) new self-fertile selections of muscadine grapes have been originated that are as good as any previous pistillate varieties and better than most, (2) promising tetraploid selections have been developed, (3) a fertile species hybrid with high quality fruit has been produced by hybridization and chromosome doubling. While these developments are important in themselves, their greatest value results from indicating germ plasm and methods of using it whereby progress in the future can be more rapid and certain in each of the above three phases of breeding.

The principle objective of the grape breeding program as reorganized in 1945, was to develop perfect-flowered varieties of high quality and good vine characteristics. Those that had recently been introduced, while very valuable as pollinators, lacked considerably in other characteristics. Selections from the first five years of breeding under the reorganized program, are better than any of the previously named perfect-flowered varieties, but probably not so good as the best named pistillate ones. Selections from the second five year period are as good as most of the present varieties. A break in the program occurred at this stage due to moving all breeding material to Clayton, N. C. In the third five year period, selections were obtained that gave every indication of being better than most of the present named varieties in vigor, resistance, productivity and fruit qualities.

Crosses made since the work was moved to the Central Research Station at Clayton, N. C., using these advanced selections as parents should show even further improvement by recombination of desirable characteristics. Some of these crosses will fruit for the first time in 1961; seeds of other crosses made in 1960 have just been sown.

MUSCALITUE GRAPE DELEDING

ameilliw . .

FOREWARD

Three important annievements have resulted from the grape breeding program; (1) new salf-fertile selections of muscarine reapes have been originated that are as good as any previous pirtillate varieties and better than most, (2) president tetraploid selections have been devaluped, (3) of ertile species nybrid with high quality fruit has been produced by urbridiation and chromosome downling, while those developments are important in themselves, where yearlies from indicating nerm plasm and methods of using it whereby progress in the friume can be more rapid and across in asch of the above tone plasms of breeding.

The principle objective of the grape breeding program as reorganized i 1947, was to develop perfect flowered marieties of high quality and good vine sharacteristics. Those that had recently been introduced, while very valuable as pollinator. lacked considerably other characteristics. Selections from the first five years of broading under the reorganized program, are better than any of the previously named perfect flowered aristies, but probably not so good as the best named pistillate over.

ion from the second five year period are as good as most of the resent variation. The break in the rogram occurred at this stage due to sying all breeding material to syton, . In the third five year

en most the present named varieties in vigor, resistance, productivity

The second of th

A STATE OF THE PARTY OF THE PAR

The letter of th

sirve the ork was rover to the journal research Station

The development of these new muscadine selections is not an end result in itself. Still more important is the assembling of the germ plasm which provided these selections; germ plasm which has not yet fully expressed itself in any one selection; germ plasm for vigor, productivity and disease resistance of plant, size and non-shattering of cluster, dry scar, size, flavor, sweetness, acidity and texture of berry.

Two tetraploid muscadine grape seedlings fruiting for the first time in 1960 were outstanding in fruit quality, and berry size, and had good vine characteristics. These are very promising selections for testing as future new varieties. They are the first indication of the possibilities from breeding within the species at the tetraploid level. Tetraploid breeding was started in 1954 and indicated little promise at first because of slow and poor habit of growth of most of the seedlings. These new selections indicate the advisability of exploring this type of breeding further. Superior parental stock with known desirable germ plasm is now available and should be polyploidized for use as parents in such crosses. It is probable that true tetraploids as they are developed by breeding will be more useful as parents than the chimeral colchiploids. Many tetraploid seedlings from controlled crosses which have not yet attained fruiting size are growing in the vineyard at present.

The first fruiting in 1960 of a tetraploid species-hybrid is a development of major importance. Such a hybrid has been sought for over 100 years. This is the first species-hybrid with muscadine grapes to have fruit of high quality and indicates that such hybrids are now possible through polyploidy. This selection is good enough on the basis of one year's fruiting to consider testing it as a new variety for introduction if the difficulties of propagation and clonal stability from its being a colchiploid can be overcome. Even so, its chief value may be in its use in breeding and as indicating the possibilities of this type of breeding.

The development of these new muscedine selections is not an end result in itself. Still more important is the assembling of the perm plasm which no rowided these selections; germ plasm which has not get fully expressed itself in any one selection; germ plasm for vigor, productivit, and disease resistance of plant, size and non-sha ering of cluster, any scar, size, flavor, we seen and non-sha ering of cluster, any scar, size,

Into strate of the plane grape seedling mitting for the Strat cine one attraction in Smit quality, and envi size, and had nood vine characteristics. These are very producing selections for senting at Smare new very ties. They are the Strat indication of the possibilities from breeding ribbin the species at the tetraploid level. Tetraploid breeding as started in Ma and indicated little produce at Strat because of slow and poor habit of growth of most of the swedlings. These new selections indicate the savisability of exploring this type of breeding further. Therefore the savisability of exploring this type of breeding available and should be polyploidized for use as parents in such process. It is probable that the tetracloids as they are enveloped by breeding will be more useful as parents than the chimeral colobicloids. Many tetraploid of redling row controlled crosses which are not vet attained fruiting size reading in the vineyend at present.

The first fruiting in 1960 of a tetraploid species-ybrid is a velopment of major importance. Such a hybrid has been sought for over 100 . is is the first species-hybrid with mucualine grapes to have trait

eniteen to

eff value be it take in breeding and as indicating

Many similar species hybrids are now growing in the vineyard at Clayton and should fruit for the first time in the next two years.

Continual examination of them will be necessary in 1961 to limit their growth to the buds and shoots polyploidized by colchicine.

By fruiting the first year from seed, this species hybrid selection has also shown how much time could be saved if more nearly optimum growing conditions could be provided. In general it has taken various diploid seedlings at least 4 years from seed to first selection, and in the process many seedlings have been lost. It has taken 6 years to fruit polyploids from seed.

This report is an outline of the work program by which the above selections were developed. It is divided into three parts, diploid breeding, polyploid breeding, and species hybridization. It is intended to indicate the procedures, the plant material used, the genetic sources of various desirable and undesirable characteristics, and some of the possibilities and problems.

eciss go: are now growing in the vineyard at out in the vineyard at out if if it time in the next two years.

Examination, them will be necessary in 1961 to limit their growth to the brds and shoots polyploidized by colobising.

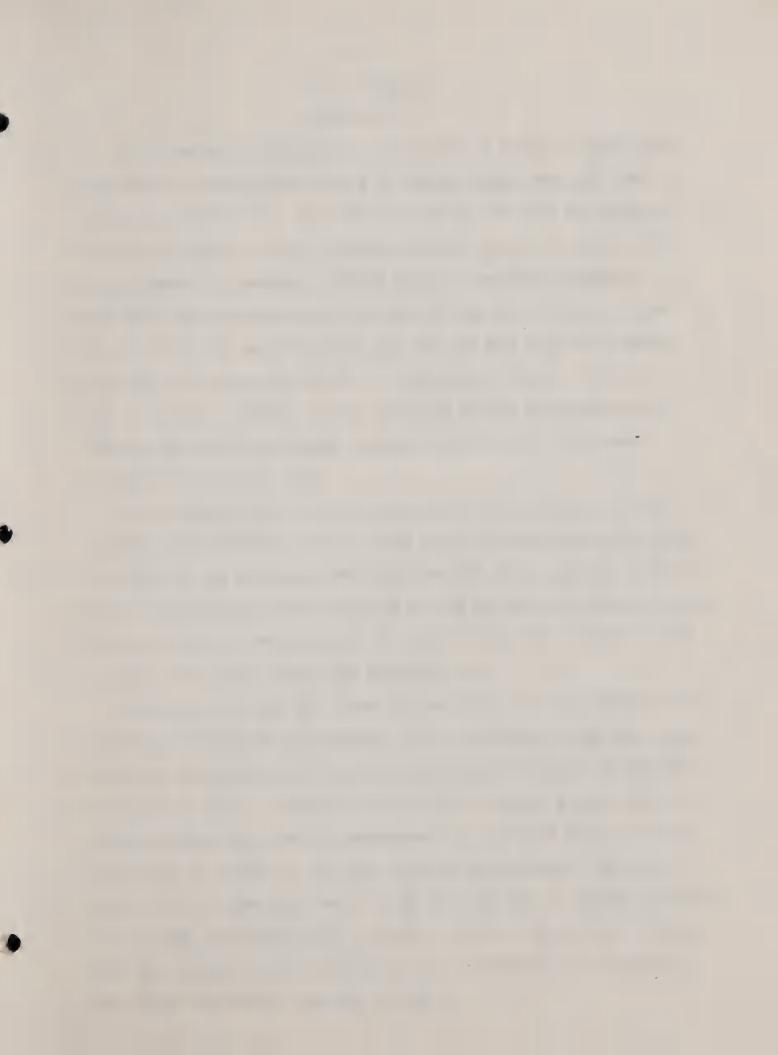
By 'mitting he first year from seed, this species hybrid selection has also shown time could be saved if more nearly optimum prowing ons sould be provided. In general it has taken various violoid seedlings at least 4 years from seed to first selection, and in the process seed in the people of the staken of years to first polyploids seed.

This is an outline of coor program by which the above

lot preeding, and species hybridization. It is intended to

. . .

e character tics, and some of the possing -





I DIPLOID BREEDING

Introduction

The muscadine grape program was reorganized in 1945-46 at which time 15 selections from previous breeding by Charles Dearing were named and introduced (3) (Table 1). The most important of these were six perfect-flowered varieties, the first fruitful pollinator varieties available for home or commercial planting. Although these are replacing non-bearing male vines for pollinators, it is doubtful if they can or should replace the best pistillate varieties where more than one vine is planted because they lack characteristics essential to successful varieties. They are inferior in fruit qualities and the best light colored perfect-flowered varieties are subject to foliage disorders caused by black rot fungus and probably by Pierce's virus.

The principal objective of the reorganized breeding program has been to combine self-fertility with high fruit quality and desirable vine characteristics. It has previously been shown that 50% of the seedlings in crosses between pistillate and perfect-flowered parents are perfect-flowered (2,6,10). The use of perfect-flowered parents in breeding also makes possible the use of pollen parents with known fruit characteristics.

Selections developed from three original sources of the perfect-flower character are available for breeding. Two of the original vines were found by Charles Dearing among seedlings being tested in the department vineyards at Willard, N. C. (1). One of these (V23 R4 B2) was from a cross made in Florida probably with a male V. munsoniana; the other (V19 R7 B2) was from a cross made at Enfield, N. C., with a male V. rotundifolia. The third perfect-flowered vine (Hope) was found in the wild by F. C. Reiner at Raleigh N.C. and used in breeding by L. R. Detjen at the N. C. Agricultural College (6). The original hermaphroditic vines have not survived but selections from crosses with each of them are available.

program was reorganized in luffed at which time

15 tection row armito breeding by Charles Dearing were mised and introduced (3) (Table 1). The most important of these were six perfectrlowered varieties, the first fruitful pollitator remieties available for home or commercial planting. Although these are replacing con-bearing male vines for pollitators, it 'doubtful if they wan or should replace the best pistillate varieties where more than one vine is planted because they lack characteristics essential to successful varieties. They are inferior in fruit qualities and the best light colored perfect owered varieties are subject to foliage disorders caused by black not fungus and mobably by Herce's vinus.

Selections devel from tiree miginal sources of the perfect-flower character are available for breeding. Two of the original vines were found Charles Dealin among seedlings being tosted in the department vineyards and, N. S. (1). Of of these (V23 R4 B2) was from a cross made in products with a male , amsoniana; the other (V19 R7 B2) was from

outid ed . . to tounds . rotund of . . The third

) was found in the wild by . . Foiner at Raleign

vines have not veo but saloctions

Inheritance Studies

From 1945 to 1960 inclusive, 163 crosses between diploid muscadine grapes have been made as well as many self-pollinations. These are listed in Table 2.

The first stages of the reorganized breeding program consisted of progeny tests of the available perfect-flowered selections by selfing and by crossing with selected pistillate varieties. Inheritance studies of these progenies indicated genetic sources for vigor, productivity, and resistance to leaf spot caused by black rot fungus, size of cluster, persistance of fruit, time of maturity and quality characteristics of sugar, acid and texture of pulp and skin (15).

The selections derived from Hope, (G-52, 25-8-26 and 37-10-1) have produced progenies of average vigor and disease resistance, good cluster, and large berry size, with rather thick skin and high acid but fair to good flavor.

The data shown in Tables 3, 4 and 5 are progeny averages for vigor, resistance, fruit size and sugar of these first crosses. Since these are averages of all seedlings in each cross, they are much lower than similar measurements for selections which would necessarily have had much higher scores to have been selected.

<u>Vigor.</u> Most of the parents used in these muscadine grape crosses have been vigorous, and in general their progenies have had good vigor unless they were severely injured by disease, defoliation or other causes. The relatively low average ratings in the tables are partly due to these data having been taken while the vines were young (1 and 2 years), crowded, and before any seedlings had been discarded for disease, sex, injuries and other causes.

The progenies of Tarheel and of Topsail were very Vigorous. Tarheel selections were also productive, resistant to black rot, and had large non-

Inheritance Studies

From 1945 to 1960 inclusive, 162 crosses between diploid magadine grapes have been made as rell as namy self-pollinacions. These are listed in Table 2.

The first topes of the reorganised breading program consisted of programy tests of the smallable nerfect-flowered selections by selfing and up crossing with selected pistillate and a laboritance studies of these progenies indicated genetic sources for vigor, productivity, and esistance to leaf spot caused by black not fungus, size of cluster, sistance of fruit, time of maturity and quality characteristics of sugar, soid and texture of pulp and skin ...

The selections derived from Hope, (6-2, 2-3-26 and 10-1) have produced procedure of average vigor and disease resistance, good cluster, and large berry 'ze, with cather thick skin and righ acid but fetr to good flavor.

The data shorn 'Tables 3, / and 5 are progeny sverages for visor, resistance, fruit size and sugar of these first prosses. Since these are ersees of all seedlings in each cross, they are such lower than similar use for selections which would necessarily have had much higher

scores to we been selected.

erely injured by ise . defoliation or other corses. The relatively

·

of Topsail were very Vigorous . Tarheel oductive, resistant to black rot, and had large no -

shattering clusters. Sixteen selections from various Tarheel crosses were used as parents in 35 different crosses. Progenies in these crosses were rated high in vigor, resistance, large cluster and persistence. Selections from these latter crosses have been used as parents in a third set of crosses.

Resistance to black rot. In the first crosses Tarheel seedlings showed the least leaf spotting from black rot fungus and those of Wallace, Willard, and Scuppernong the most, Table 3B. In later crosses the more resistant selections have been used as parents where this was possible considering the other characters desired from the cross. Although ratings made in different years and locations are not entirely comparable it is probably a fair observation that less infection from leaf-spot caused by black rot is presently found in progenies of the more recent crosses, especially when the comparisons are made with established varieties as standards. Probably complete resistance does not occur. However, frequently it has been impossible to find any leaf spot on some selections when adjoining ones were infected. Seedlings in more recent crosses whose parentage included Tarheel have been more resistant to black rot than those with other parentages.

Other diseases. Tarheel is more susceptible to downy mildew than any other muscadine grape observed. This disease reduces fruit setting and causes severe russetting on the berries. Susceptibility was transmitted to Tarheel progenies, especially in the cross Topsail x Tarheel (Cross 11). Following generations are less susceptible indicating that V. rotundifolia in general carries considerable resistance.

Infection from cercospora leaf spot frequently is severe in late summer and during harvest on mature leaves. It may cause severe defoliation. Ratings of varieties and seedlings for this disease have not been consistent.

Severity appears to be associated with maturity or condition of foliage which

shattering clusters. Sixteen selections from various Tarkeel crosses were used as parents in 3f different crosses, Progenies in bless crosses were reted night in vigor, resistance, Large cluster and persistence. Selections from these lather crosses have nown used as parents in a third set of crosses.

Nest the least leaf smotting from olack rot fungus and those of dalkace, Villera, and companions the most, Table . In their ordinate the news recisions also tions have been used as perends where this as possible considering the object one inset are not the cross. Although restings made in different years and locations are not entirely companie it is probably a fair observation that less infection from the cross of ordinate by olack rot presently found in progenies of the more re out presently when the companies of the more re out presently when the companies of the more re out presently that as sent the constitute from times once with established varieties as standards. Probably complete restentiance notes not occur. However, freq ently it has seen impossible to find any leaf tool or some selections have included farmed have been more resent crosses whose parentness included farmed have been more

Other diseases. Tarheel is more susceptible to denor mildew than any other suscedine grape observed. This disease reduces fruit setting and causes severe russetting or the berries. Susseptibility was transmitted to factoral properties, especially in the cross Topsail x farheel Cross 11). Following generations are less susceptible indicating that . retundifolis in general carri

Infection for the comment of the source of the comment and during vest unreleave. It may cause severe defoliation. Sel-

probably is related to environmental conditions. It may appear to be more severe at any one date on some varieties and selections than on others, while at a later date the situation may be reversed or confused by defoliation.

Pierce's disease. Little can be added to the information concerning resistance, tolerance or immunity to the virus of Pierce's disease. Except possibly for the extremes at each end of the scale, clear cut symptoms have not been evident to this observer. Most of the successful older varieties must be fairly tolerant. However, infection may be the cause of low yields as on Scuppernong and for very variable annual yields and vigor. Partial occlusion of the conducting vessels might account for the severe effects of unfavorable environmental conditions on infected plants.

Infection appears to be more rapid and severe in some populations of seedlings than in others, indicating genes for resistance or susceptibility to the disease or to its vectors. Propagations of some selections have declined very rapidly when planted in a different location than that of the original plant. If the occurrence of the virus is as common and wide spread as is supposed, rougeing or eradication of infected plants will probably be of little advantage. Since differences occur among seedlings and seedling populations, considerable promise does exist for developing more resistant sorts. This would be more rapid of definite determinations of infection could be made. It is possible that other viruses may complicate the situation.

Berry size has been determined by weight of a sample usually of ten berries. This measurement was taken annually of all varieties and selections and, until 1957, of representative samples (100 vines) of most progenies.

Average berry sizes of progenies in most of these first crosses shown in Tables 3C, 4 and 5 were small, between 3.0 and 3.5 grams.

Although the permiss of the variety scheel are smaller than those of the other varieties used as parents, and those of its precent from self-rollination were extremely mall (1.89 grans), the average size of the fruits of the ordered whom crossed with other varieties was no smaller than that is other process.

Jerries of Copseil seculings (Table 30) very above A greens in

Three selections from ucital process (40 20-201, 10 10-1) and 40 28-292)

one from Jopenil (40 00-60) and the variety Topenil transmitted perty size to their upopenies in the next series of crownes. Of 100 selections in the soudling vineyard in 1960, 18 had as average bergy size of 7 grans on ...

Fourteen of these bad sitter Topeich or Lucius parentage and 3 of the others were pistillate selections.

 Although the berries of the variety Tarheel are smaller than those of the other varieties used as parents, and those of its progeny from self-pollination were extremely small (1.89 grams), the average size of the fruits of its progenies when crossed with other varieties was no smaller than that in other crosses.

Berries of Topsail seedlings (Table 3C) were above 4 grams in size. Three selections from Lucida crosses (NC 27-229, NC 28-193 and NC 28-222) one from Topsail (NC 60-60) and the variety Topsail transmitted berry size to their progenies in the next series of crosses. Of 106 selections in the seedling vineyard in 1960, 18 had an average berry size of 7 grams or over. Fourteen of these had either Topsial or Lucida parentage and 3 of the others were pistillate selections.

The fact that only perfect-flowered vines were saved from the crosses made in 1946-1947 and 1948 may account for the slight difference in berry size between crosses and for the generally small size in these crosses (8). Both the perfect-flowered and pistillate vines were fruited in 13 of the crosses made in 1949-1950-1951. In each of these crosses the berries of the pistillate vines were larger than those of perfect-flowered vines, the average increase in size being 17.8% (Tables 6 and 7). The larger berry size of pistillate vines was not due to their being less productive or having more seeds per berry than those of the perfect-flowered vines (16). This would indicate a linkage of berry size with sex. However, in crosses where Lucida was one parent, the average berry size of both pistillate and perfect-flowered vines was large with an increase of only 1.8% in relation to the pistillate flower type. This would suggest an absence of linkage in Lucida (Table 6). A comparison of berry size when different pollen parents were crossed on Scuppernong, NC 25-8-26 and Thomas indicate that

Although the berries of the variety farthed are amoid than then the solution that the ciner variety as personal as parents of its property and (1.89 grams); the average size of the faults of its progenies then crossed with other varieties was no smaller than that in other crosses.

Berries of Topsail seedlings (Table 3C) were above 4 grams in size.
Three selections from Lucida crosses (MC 27-2.5, MC 26-193 and MC 28-222)
one from Topsail (MC 60660) and the variety Topsail transmitted berry cise
to their progesies in the next scrits of crosses. Of 106 selections in the
seedling vineyard in 1966, 18 had an average berry size of 7 years or over.
Fourteen of these had citier Topsial or Lucida parentare and 3 of the citers
were pistiliste selections.

The fact that only perfect-flowered vines were saved from the crosses made in 1946-1947 and 1948 may account for the slight difference in berry cise between crosses and for the generally small size in these crosses (8), 90th the perfect-flowered and pictillate vines were fruited in 19 of the crosses made in 1949-1970-1971. In each of theme crosses the neurism of the pictillate vines were larger than those of perfect-flowered vines, the average increase in size being 17.8% (Tables 6 cmd 7). The larger berry are of pictillate vines were not one to the being less productive or invites more seeds per berry than those of the perfect-clowers vines (16), increase fundia was one perent, the average berry size of note pictillate flower, in crosses to the ristillate flower type. This would suggest an absence of littlese in harder (Table 5). A comparison of heavy size when lifterent pollen in lander (Table 5). A comparison of heavy size when lifterent pollen in lander were treased on Scroppernous, M. 25-2-26 and Fromen inficate that

NC 11-173 as pollen parent transmitted genes for berry size (Table 7). The possibility that the larger size berries of pistillate vines is due to a hormone stimulation from cross pollination, with an absence of such stimulation in self-fertile vines was neither proved nor disproved because of the difficulty of preventing self-pollination of perfect-flowered vines without injury to the flowers or pistils by emasculation.

Sugar was determined as total soluble solids with a hand refractometer.

Measurements have been taken annually of all selections and varieties, and
until 1957 of representative samples (about 100 vines) of most progenies
from the first 71 crosses.

Latham, and its seedlings Topsail and V21 R15 B2 from previous breeding, are high in sugar and flavor. Progenies in crosses with one of these as a parent were high in sugar (Tables 3D and 4). Many selections from these crosses had refractometer readings of 22 and 25%, and one seedling had a reading of 32.5%. When several of these selections were used as parents in crosses, the resulting seedlings were high in sugar and flavor. The variety Thomas probably has contributed to the sugar in some of the progenies, by itself and through its seedling Burgaw. In contrast to this, progenies of Wallace, Duplin, Lucida, and Cape Fear were low in sugar, unless the other parent had relatively high sugar.

Acidity has been determined only by taste. It is more important quality than this would indicate. A method of measurement for use in the field as simple to use as the hand refractometer for sugar would be valuable. In these crosses the acidity of Duplin and its progenies was especially sharp. The acidity in Hope progenies was high but not as pronounced because sugar was higher in these crosses than in crosses with Duplin. The fruit of Wallace and Lucida seedlings seemed acid in flavor, probably

We lightly so sollen parent remarkabled genus for berry size (Tabil. The possibility that the ager size berries of istillate vines is due to a hormone stimulation from cross pollination, with an absence of such atimulation in self-fertile vines as neither proved nor disproved lecause of the ifficulty of preventing self-pollination of perfect-flowered vines with out injury to be flowers or sixtile by emacculation.

Sugar was etermined as total sol ble solids with a hand refractureter, Measurements have been taken sumually of all selections and variaties, and until 1957 of em esentative samples (about 100 vines) of most proposites from the first VI crosses.

Lachan, and its seedlingu Topcail and V21 %15 %2 from previous breeding, are high in sugar and flavor. Progenies in crosses with one of these as a perport were high in sugar lables 3D and . tany selections from these crosses had refractomete residings of 22 and 15°, and one seedling had a diag of 32.5°. When several of use selections were used as parents in crosses, the resulting seedlings were high in sucar and Clavor. The veriety Thomas probably as contributed to the tast in some of the propenies of itself at through its seedling. They, In contrast to this, progenies of wallace, sit. Sucise, and Gap. Fear were low in surar, unless the other parent had relatively his mgs.

Acidity has been stermined only by tante. It is a more important possibly than this would indicate. A method of measurement for use in the field as simple to use as the hand remember for sugar rould be valuable. In these crosses it acidity of Duplin and its progenies was enucable. In these crosses it acidity in Mope progenies was aigh but not as pronounced sause sugar was righer in these cases with huntin. The

because it was usually associated with low sugar. There is a need for selections with some degree of acidity in the breeding program, at least for the processing market. Selections for breeding from Duplin crosses have been saved and used for this purpose. The acidity can and should have a pleasing flavor.

Flavors, especially desirable ones, are probably olifactory and aromatic due to very minor amounts of esters and alcohols. Strong pleasing grape flavors are found in Latham, Thomas, Creswell, and V21 R15 B2. Seedlings of these parents were generally well flavored. In contrast, Cape Fear and Tarheel have distinct varietal flavors which are flat and undesirable. These may be due to their being low in aromatic compounds and sugar. This quality is transmitted to their progenies. Lucida has a less pronounced unpleasant flavor which is found in some of its seedlings. A personal observation would be that many of the other varieties used as parents lacked any particular flavor other than sweetness or acidity, and therefore they had little to contribute in the way of flavor qualities. The strong musky flavor that is characteristic of many muscadine grapes (but not confined to this species) was rarely pronounced in any of the progenies in this breeding program.

Productivity ratings of seedlings have been taken for most of the progenies in the breeding program. Averages for seedling population must be calculated from data taken before any discarding has been practiced during the first year of fruiting while the vines are severely crowded. They are therefore very low and of slight value and are not presented in this report. Low productivity has generally not been a problem of selections after they were of sufficient age (4 or 5 years). In 1960 most of the selections being tested in the overhead vineyard had yields of 50 lbs. or over, and several had yields of over 100 lbs. (10 lbs. per vine = 1 ton

done or many or or the property of the party of the party

included have carents very constant and the same of play of feet or and all all the terms of the care of the care

Towned have the transferred to trong the standard of the same and correct transferred to transmit ted to eit to quier. Man the same and correct transmit ted to eit to quier. Man the same is seed in a same in a seed in a same in the same of the same in the same of the same in the same is same in the same i

Thought records on the sources paths to the same of the sources of the same of

-heard side of seinerger of in which

To team soft assist stand putter ass

There profess brigging materials and the second sec

Alminoration and the second and the

ල සැට අත් විය වැනුව අරතුරවලට

per acre). In the breeding program where low productivity has occurred, it probably has been due to factors other than inherited capability. Very high productivity has been found in some crosses. Large cluster size frequently is associated with high productivity. Thus Tarheel as a parent has given productivity in crosses, and F1 selections of Tarheel when used as parents in crosses have produced very productive seedlings.

Cluster. Large cluster size is characteristic of Tarheel, Duplin and their progenies, and has been transmitted through three generations. It also appears in other progenies, notably some of those derived from Hope. Evenness in time of bloom probably increases percent of fruit-set within the cluster and contributes to cluster size and to its compactness. To be satisfactory the cluster should not be too compact and a large frame-work is needed as well as a long cluster-stem to facillitate picking. Compactness is also affected by berry size. Shape of cluster is variable from broad, with or without a distinct shoulder to cylindrical. All these characteristics are found in the breeding material and have been selected.

Persistance of fruit or non-shattering of cluster is especially important if the fruit is to be harvested in clusters. In any case, berries need to hang on the vine until harvested. On the other hand if berries are to be harvested loose with a dry scar like plums, extreme persistance causes tearing of the skin, pulling the brush out of the berry, and broken skin from too much pinching. All of these factors result in wet, poor quality fruit which deteriorates rapidly. Loose fruit with dry scar can be harvested rapidly and graded and packaged readily. It is ideal and probably necessary for mechanical harvesting. These are characteristics desired in other grape regions, which muscadine grapes already have naturally. Both types of varieties probably have a place on the market and have been selected.

is acre). In the inceding ogram where low productivity has comprec, it probably has been due to factors other than inherited capability. Very high reductivity as been for in some or as es. Large cluster sine frequently it associated with high productivity. Thus Tarbeel as a varent has given productivity arcases, and Iq solvetions of Tarkeel when used as parents in arrayes have produced very productive seedlings.

Dustar lary sluster five is characteristic of Tarheel, Suplin and their properties, and has been transmitted ough three generations. It also spicers in other organis, notably some of those derived from Mapo, wenness in time of bloom probably increased nearcent of cruit-act ithin the cluster and contributes to cluster and contributes to cluster and to the Compacines. To be patisfectory the luster choule not be too contact and a large framework is needed as well as a one cluster to facilitiate in formactions is also affected by corry size. These of cluster is variable from mose is also affected by corry size. These of cluster is variable from the organ, with or without a distinct shoulder to cylindrical, all these characteristics are found in the preeding material and have own selected.

Fercisegace of fruit or non-shattering of elaster to especially important if the Truit is to be harvested in elastera. In any case, burries need to harp on the vine until harvested. On the other hand if berries are to be narvested lose with dry sear ise plant, entremt persistance careen frim of he skin, has the brush out of the herry, and broken whin our to smen pinching. All of these actors result is wet, coor quality for hick eriors which are seen to harvested in hick eriors uptile. It i ideal and probably necessary and gate and part readily. It i ideal and probably necessary entited narwesting.

The second secon

Shelling of berries is associated with and aggravated by uneven ripening.

In this, muscadine grapes are no different than other genera, very few of which mature all of their fruits on the same date.

Even ripening within the cluster is essential for cluster harvesting and uniform ripening of a variety is important for commercial harvesting by any method. Some of the named varieties like Scuppernong, Thomas and Topsail are very uneven in ripening. This is probably the principle reason for their shattering so badly before and during harvest. Some varieties like Hunt ripen more evenly and persist well enough so that they can be harvested in one picking for the processing market. Many of the present selections from the breeding program ripen very uniformly and can be harvested in one picking. None ripen evenly enough for all of the berries to be top quality for the fresh fruit market with one picking, but with some selections 80 to 90% of the fruit is satisfactory at one time. This characteristic of even-ripening has not been associated with any particular parentage, but has been found in all breeding lines. It is least in progenies of Scuppernong and Topsail.

Soft pulp. Fruit with very soft or melting pulp occurred in seedlings from self-pollination of Duplin. This should be a valuable fruit character for processing for juice. Duplin was used as one parent in crosses with Latham, Topsail and Hunt, and transmitted this characteristic in some degree to many of its seedlings. A high percentage of them had softer than average pulp but very few had completely melting flesh in which most of the pulp disappears. Duplin also transmitts high acidity.

Sex. The progenies from self-pollination of the original hermaphroditic selections, differ in the inheritance of the three flower types (pistillate, staminate and functional hermaphroditic) (11). Those from "Hope" and V19 R7 B2 include seedlings of each of the three flower types. Similar progenies

shelling of perries is associated with and aggravated by uneven ripering.
In this, amsociate grapes are no different than other generu, very few of which astore all of their ruits on the same

end antiform ripening of a veriet, is important for convercial betweether by any method. Some of the named verieties like Sonpernance. Thomas and Topesail are very uneven of the named verieties like Sonpernance. Thomas and Topesail are very uneven or riceria. This is probably the orimal, a case and for their anatuering so had, sefore and during narvest. None varieties like and cipes more evenly and parsist well enough so that they can be harvested in one picking for the proposating ranket. None the proposating ranket. None we harvested one fields, whose rices evenly enough for the berries to be top antity for the fresh trust market with one picking, but with some as ecutions for the fresh truit market with one picking, but with some as ecutions 60 to for the fresh truit market with one picking, but with some as ecutions 60 to one of the fresh truit is satisfactory at one of the parentage, but has been found in all meeding lines. It is least in tropenies of Somparno poem found in all meeding lines. It is least in tropenies of Somparno poem found in all meeding lines. It is least in tropenies of Somparno poem found in all meeding lines. It is least in tropenies of Somparno points.

from set spollination of Ouplin. This should be a valuable fruit character for rocessing for juice. Duplin was used as one parent in crosses with Leth. If and Hunt, and transmitted this characteristic in come degree is a second.

from V23 R4 B2 include only seedlings with pistillate or hermaphroditic flowers and none with staminate flowers. One parent of V23 R4 B2 was V. munsoniana while both parents of V19 R7 B2 were V. rotundifolia which may account for the difference in the mode of inheritance. On this basis it is presumed that both parents of Hope were V. rotundifolia. No clones that were homozygous for perfect-flower type were found until recently when Loomis identified one selection M 36-2A as such. (12) Two seedlings M 44-8C and M 45-9C resulting from self-pollination of M 36-2A also are homozygous for perfect-flower. The small berry size associated with perfect-flower type may result in especially small berries on vines which are homozygous for this character and thus act as a selection index against their being tested or used in breeding.

One of 83 seedlings resulting from self-pollination of Burgaw had staminate flowers on the main part of the vine. This vine developed a branch of normal vigor which for five years bore functional hermaphroditic flowers which set fruit from self-pollination. This would suggest that in this breeding line from V19 R7 B2 that the characteristic of perfect-flower originated as a mutation from the staminate form.

This mutation was lost when the breeding stock was moved from McCullers to Clayton, N. C. The top of the vine died back to a point below the origin of the mutation. It is probable that other similar chimeral plants have been lost during the elimination of male vines at the time of bloom. Only when male vines were found in progenies where they were not expected were they carefully examined and not always there when the work was performed by student labor.

Progenies from self-pollination

Populations from self-pollination of perfect-flowered vines have been

From 193 RA. Do insinde only seedlings with pishilate or nemeromonitic flowers and none with staminate flowers. One parent of 192 RA 32 was an account for the diff ends in the mode of inheritunce. On this costs has never end that both marches of Hope were a roturificial which the presumed that both marches of Hope were a roturificial. No clones that were nomeargons for perfectioner type were formed until recently then book identified one selection N 35-2A as . . . (12) "we serdlings R AA. Comis identified one selection N 35-2A as . . . (12) "we serdlings R AA. For perfect-flower. The small perfect associated with certect-flower type was associated with certect-flower type may result in especially small perfect or vines which are becoupyeous for this character and thus act as a calection index swainst their being mested or used in breastng.

One of 82 sectlings resulting from self-pollination of Burgaw bud staminate flowers on the main part of the first the developed a branch of normal vip which for five years here functional harmaphrobitic flowers which set fruit from self-pollination. This would suggest that in this secting line from VIG 27 E2 that the characteristic of perfect-flower originated as a mutation from the staminate form.

This ation was lost when the breeding stock was noved from McCuilers to Clayton. . The top of the rine died back to a point helow the origin of the entation. It is probable that other similar chineral planes have been lost during the alimination of male vines at the time of bloom. Only then male vines were found in progenies here they were not expected were they earefully examiled and not always there can the wor was performed

and the second second

9

grown. These include the 6 named varieties and 8 numbered selections from Dearing's breeding work at Willard, N. C., 30 of the selections grown at McCullers, and two derived from Hope. The vigor of these progenies was reduced but in most cases not extremely so. That of Tarheel and Duplin seedlings was good.

The berry sizes of selfed progeny of all of the Willard selections except Duplin, were very small, some progenies having berries not more than 1/4 to 3/8 inches in diameter. This small fruit size was found for all the progenies from selfing the selections at McCullers which were derived from the Willard material, except N. C. 11-173, some of the seed-lings of which had fair sized fruit. Seedlings from selfing N.C. 25-8-26 and N.C. 37-10-1 (from Hope) also had fruit of fair size.

Seedlings of Duplin x self had very soft and melting pulp. Some of these were the only S1 selections used as parents in breeding and are the only such S1 selections (pure muscadine) in the breeding stock at present (Jan. 1, 1961.)

A summary of the source of various characteristics is given in Tables 8 and 9.

Inese 'uclo 'the 6 mared varieties and 8 mbersd selections from 'up's precing work at Willard. N. ., 30 of the selections prown at 'NcCallers, and two derived from Hope. The vigor of these progenies was reduced but in most cases not extremely . That of Imrheel and haplin seedlings was

The berry tree of selfed progeny of all of the Willard setabline except win, ere very small, some properties having berries not nore than 1/4 to 3/8 nches in 'emet. This small fruit size was found for all the progenics from selfing the selections at defullars which were derived from the Willard material, except. . . 11-177, some of the lings of which had rair sized 'em'. Seedling from selfing. . 25-2-26 and . . 37-10-1 from ione) size had fruit of fair ties.

Seedlings of Duplin x self had very soft and melting pulp. Some of ese were the ply S1 selections used as perents in breeding and are the only such S1 selections (pure muscuaine) in the breeding stock at present (Jan. 1991.)

.

of the source of various characteristics is given in Tables

Selections

The first crosses of the reorganized breeding program starting in 1946 and using the perfect-flowered varieties then available as the source of this character, produced perfect-flowered selections that were better in fruit and plant characters than their parents. Although they were not better than the good pistillate varieties, they have been tested as rapidly as possible for use as better quality pollinator varieties. Fifteen of these selections were sent to Experiment Stations in the southeastern states for testing, Table 10. At present, January 1961, five selections are sufficiently promising for release, NC 27-262, NC 29-193, NC 9-305, NC 59-32 and NC 60-60, although the last three have been tested only in North Carolina.

Two other selections should be given consideration for release as very early sorts of good quality ripening in late August, NC 15-229 (black) and NC 115-180 (light). These were discounted for shelling in preliminary testing as their fruit was past its prime by September 1 when other seedlings and selections were beginning to ripen.

Ten other of the older selections are still under consideration. The first four have performed well in Georgia and Mississippi and the last six appear better than these in North Carolina but have not been tested elsewhere; NC 11-173, NC 11-186, NC 27-128, NC 33-13, and NC 29-32, NC 29-115, NC 29-156, NC 33-98, NC 44-15, NC 57-56.

Selections originated in crosses in which some of the first selections were used at the source of the perfect-flower characters indicate further improvement and several appear to be as good as most of the pistillate varieties so that their use would not be limited to pollination purposes. Preliminary tests of these for possible release were interrupted by moving Research Stations. In recent years pistillate vines have been selected in many promising crosses chiefly for use as seed parents in further crosses. The made possible more combinations and larger populations with both parents from

The first crosses of the reorganized breading progress starting in 1946 and metry the perfect-flowered and earlies to everyshead as the source of this character, counced particul-flowered selections that were petter in fruit and clent characters than their parents. Although they were not often the the took pistill te verieties, they have been tested as rapidly as possible or see as better quality politicator.

Wifteen of these selections were sent to superiment thatfore in the southeastern status for testing, Table 1. At present, January 1961, five selections are sufficiently promising for release, NC 27-202, NC 29-193.

NO - NO - nd NO - 1, Ellhough the last three have been tested only in North Caroline.

Two other selections should be given consideration for release as very sarly sorts of good mality ripening to late August, WC 15-229 bluck) and MC 115-180 (light). These were discommed for shelling in preliminary testing as their fruit was past its prime by Esptember 1 when other seedings and selections were beginning to ...

Ten ther of the clder celections are still under consideration. The first four have performed well: Georgia and Miscissippi and the last six appear better than these in North Carolina but have not been tested elsewhere the NC -124. NC 27-125, NC 27-125, NC 27-125.

not be limited to politaction

One release were interrupted by moving
ears pistillate vines have be selected in

for nee as seed parenus in crosses. This bas

advanced breeding without the difficulties and restrictions from emasculation.

Seedlings from such crosses are now fruiting and have produced selections that promise to be superior in fruit and vine characteristics to anything previously developed. These should be tested as rapidly as possible.

All present selections are classified in the inventory of grape material in Table 24, (1C and 2A) according to their evaluation with brief notes as to their chief characteristics. Of 54 selections originated at McCullers and moved to Clayton, 33 now remain, some of which are of value principally as breeding stock.

A few of the selections discarded at Clayton after 1960 still remain in the testing vineyards at Willard and Jackson Springs. These should be replaced by newer, better selections as propagations become available as has been done at Clayton.

In general, selections from this breeding program have been more productive than most of the older varieties. The most satisfactory and comparable yield records have been secured at Clayton, N. C., Table 11. These vines were planted in the spring of 1956. They bore a little fruit in 1958 and were hardly in full bearing in 1960. However, at that time many of the selections bore yields of a bushel of fruit per vine (50 lbs.) and several bore twice this amount.

Edvanced breeding without the Wifford these and restrictions from emescription. Seedlings from such prosses are now from that promise to be superior in truit and vine characteristics to anything provided as remidly as cossible.

All present selections are classified in the inventory of grape material in Table 24. (10 and 24) according to their evaluation with prief notes as to their chief characteristics. If 54 selections originated at McCullers and moved to Clapton, 33 now remain, some of which ere of value principally someofing stock.

in the testing vineyards at hillard and Jackson Springs. These should be replaced by newer, better selections as propagations become available as has been done at Clayton.

In general, selections from this breeding program have been more productive than most of the older varieties. The most satisfactory and comparable yield records have been secured at layton, . . . Table ... These vines were planted in the spring of ... They bore a little fruit in 1977 ... were hardly in full bearing in 1960. However, at that time octions tore yields of a bushel of fruit per vine (50 lbs.)

.

II POLYPLOID BREEDING

Colchiploids

The first recorded tetraploid muscadine grapes were those originated by Dermen with colchicine in 1953 (4). He was successful in treatments of 16 varieties and selections, and in following years induced tetraploidy in 5 other varieties, Table 12. These were planted in North Carolina in 1954 and bloomed for the first time that year.

From two to five polyploidized plants of each of the 21 clones have been grown and observed as well as rooted propagations of several of them. Some of the propagations have been sent to other locations for observation (Table 13).

In order to have satisfactory measurements of the effect of tetraploidy on vigor, productivity, disease, etc., it would be necessary to grow propagations of the diploid and colchiploid forms of the same clones, that were comparable in age, condition and environment. Such a test was attempted with two-plant plots of both forms of 13 varieties. After four years the test was discontinued because of the failure of either the diploid or the tetraploid vines of several of the clones to become established.

Growth. The selections have reacted differently to induced polyploidy in growth as shown in Table 12, but all of the vines of each clone have reacted similarly, indicating that differences are due to a clonal (not individual) response. Nine of the colchiploids have been rated as very vigorous and 5 of them as normal in vigor. Three of the clones, Topsail, Yuga, and M 14-5A have been less vigorous than diploids should have been and have had poor foliage with necrotic areas (flecking). These responses are not believed to be due to colchicine treatment but to be caused by disease, although the symptoms may have been intensified by the treatments.

TI POLYPLOTE BELLDING

Colchiploids

The first recorded tetrupleid suscediar grapes were those originated by bermen with colonicine in 1957. ... He was surcessful in treatments of lowerieties and selections, and in following years induced cetraploidy in 5 other warieties, facter. These were planted in North Carolina in 1954 and bloomed for the first time that year.

ron two to five polyploidized plants of each of the 21 clones have been grown and observed as well as rooted propagations of several of them. Some of the propagations have been sent to other locations for observation (Table 13).

In order to have satisfactory measurements of the effect of tetroploidy on visor, productivity, disease, etc., it would be necessary to grow propagations of the fiploid and colemble forms of the same close, that were comparable in are, condition and sarironment, such a test was attempted with two-clast plots of both forms of 12 varieties. After four years the test as discontinued because of the failure of either the diploid or the tetraploid vines of several of the closes to become osteblished.

rowth as shown in Table 12, but all of the vines of each clone have reacted similarly, indicating that differences are due to a closal (not individual).

Individual)

individual in vine of the colchiploids have been rated as very virorous is of them as normal in viror. Three of the clones, Tabasil,

 Four clones, Scuppernong, Dulcet, NC 17-197 and M10, were very much stunted and dwarfed. Terminal buds on the shoots of these plants developed soon after the initiation of spring growth causing a cessation of length growth. Total annual length growth of shoots sometimes amounted to only few inches. Leaves of the dwarfed plants were smaller than normal but were dark green and no more susceptible to foliage disorders than those of diploid forms of the same clones. Gibberellin sprays applied (1) as buds were breaking, (2) on tender new shoots, (3) about one month later failed to overcome the dwarfing.

Other growth responses to tetraploidy are similar to those reported for other species; shorter thicker internodes, generally more acutely angled nodes, rougher bark, thicker leaves, larger buds, especially flower buds. Stomatal measurements showed a length of 27-29 microns vs 19-24 for diploids. Stomatal size was somewhat variable and in any case. indicated only the ploidy of external layer. Such measurements might be helpful with seedlings to establish a difference between diploid and tetraploid plants but did not identify triploids because of overlapping ranges in size. Dry pollen grains of tetraploids had a length of 33-39 microns vs 27-31 for diploids. When pollen is available, its size should distinguish between diploids and tetraploids. Pollen samples of colchiploids contained many abnormal grains and a lot of "trash" - in comparison with samples of comparable diploid clones. Germination in sugar solution frequently was as low as 1 or 2%. A cytological study of mitosis might explain the reasons for the low yields viable seeds in some crosses, and aid in selection of parents, especially when colchiploid plants are to be used.

<u>Productivity</u> of the original colchiploids has been variable but was rated as satisfactory or better for most of those that were vigorous.

Four clones, uppersone, Dulcer, NG 17-197 and MIO, were very much ad and sarfed. Terminal buds on the shoots of these plants developed soon after the initiation of apring growth cameing a cossection of leapth growth, fotal annual length growth of shoots sometimes amounted to unly a few inches. Leaves of the dwarfed plants were smaller than normal but were dark see and no more suscentifile to foliage disorders that those of diploid forms of the same closes. Gibberellin sprays applied (1) as buds were breaking, (2) on tender sew shoots, (3) about one month later tailed to overcome the imarking.

Scher growth responses to tetrenloidy are dimilar to those renorted for other species; shorter thicker internodes, generally more unitely angled soder, rougher bark, thinker leaves, larger buds, especially flower ds. Stometal measurements showed a length of 27-29 microns vs 19-24 for ofploids. Stonatal size was somewhat variable and in any cases indicated only the plotdy of external layer. Such measurements might be helpful with seedlings to establish a difference between diploid and tetraploid plants but did not identify triploids hecause of overlapping es in size, Dry pollen grains of tetraploids han a length of 33200 distant vs 27-31 for diploids. Then pollen is available, its size should etiaguish between diploids and tetraploids. Follen sumples of codes:ploids contiined many abnormal grains and a lot of "trash" - in comparison it semm es com le diploid clorer. Germination in surar solution tonim sisolim le brit lasigoloty, A . 15 to 1 as vol as a explain the casons for the low yields viable seeds in some crosses, and in sele tion o parents, especially her colorabloid plants are to be

better ', most of those that were vicorous,

.

NC 20-30 has been especially productive. Production of the varieties that were dwarfed was relative to their size capacity. Topsail has had almost no fruit, Dallas has had none (very subject to black rot), M6-4A and Hunt have borne very little fruit. Possibly in general the pistillate varieties have been less productive than the perfect-flowered ones, although the two forms have been interplanted to insure cross-pollination.

Berries. Berries ripened earlier on tetraploid vines than on diploid vines of the same variety. This difference in time of maturity was small for early ripening and mid season varieties (3-5 days) and greatest for late varieties like Creek and Higgins. Tetraploid Higgins ripened 30 days before that of the diploid vines. No differences were found in total soluble solids by refractometer measurements or in flavors by tasting. No differences were recorded for texture of pulp or skin.

The conspicuous difference between diploid and tetraploid vines was in size of berry as shown in Table 14. This increase in size was variable but generally was about 30% by weight. It was least for NC 17-197, selection which was much dwarfed from the colchicine treatment. Selection M10 and Scuppernong were as severely dwarfed as NC 17-197 yet the berries of these were considerably larger than those of the diploid vines.

The increase in berry size was not due to greater fertility or a larger number of seed per berry. Tetraploid berries had fewer seeds and were larger than diploid berries containing the same number of seeds, Table 14.

Scatter-grams of size of berry in relation to number of seeds for NC 11-178, NC 20-30, M7 and M10, are shown in Figures 1, 2, 3 and 4. Data for several of the other colchiploids showed similar distributions. Seeds of tetraploid berries were larger than those of diploid berries of the same selection.

NC : - nas been especially reductive. Production of the vericties had had were dwarfed was relative to their size capacity. Topsail has had almost no fruit, Ballas has had none (very subject to black not), No-AA and first have borne very little fruit. Possibly in general the distillate varieties have been less productive than the perfect of lowered ones, although the two forms have been interplanted to insure arcss-politon ton.

bucking. Benries ripemed earlier on tetraploid vines than on diploid vines of the same variety. This difference in time of raturity was small for early ripeming and mid season variaties (3-5 days) and preatest for late varieties like Oreek and igins. Tetraploid Higgins riceaed 30 days before that of the diploid vines. No differences were found in total roluble solids by efractometer measurements or in flavors by allow. No differences were recorded for texture of pulp or skin.

The spi our difference between diploid and tetraploid vines was in size of berry as shown in Table W. This increase in size was variable but generally was about 30% by weight. It was least for aconomy, a selection which was much dwarfed from the colonicine treatheat. Selection MIO ad Scuppernoug were as severely dwarfed as aconomy wet as severely dwarfed as aconomy were severely dwarfed as aconomy were aconomy were as severely dwarfed as aconomy were aconomy were aconomy were aconomy were than those of the diploid in the supplication.

he incresse in berry mise was not due to presider fortility or a larger number of eed per perry. Petraploid berries had fewer seeds and re larger than diploid berries containing the same unber of seeds Japle

Tame size of " ' |

11 -1

ter cole iploids shoved similar did ribut ons. Seeds

than those of iplois service of the

Propagation. These colchiploid plants have been more difficult to propagate than the diploid vines of the same clone. This was especially true when using dormant cuttings. Aerial layers and soft-wood cuttings developed roots but generally failed to develop new shoot growth and become established. This was pronounced for propagations of these colchiploids that showed dwarfing like Scuppernong, or were weak like Topsail.

Propagations of 4x 20-30 were planted in the test vineyards at Clayton, Willard and Jackson Springs. Growth, yield, and quality of fruit at Clayton were very good. This tetraploid selection appeared to be sufficiently promising to be tested for possible release as a new variety. In 1959, a propagation test was made using 600 soft-wood cuttings in various treatments. Similar tests were conducted with diploid Thomas. Average rooting of both varieties was 91%, however, only 14% of the rooted cuttings of 4x 20-30 produced shoot growth while 51% of the 2n Thomas did so. Of the cuttings lined out in the nursery in 1960, 56% of each kind survived but the plants of NC 4x 20-30 made an average growth of only two feet in comparison with four feet for the Thomas plants. The plants of 4x NC 20-30 were very variable in vigor, many being very weak.

Propagations of many of the other colchiploids have been slow growing, stunted or difficult to get established, even those of which the original colchiploid has been vigorous. Many of these propagations have had poor stunted root systems. It would appear that polyploid tissue produces poor roots and in the colchiploids, the vigor of the root and plant may vary with the proportion of polyploid tissue involved.

Breeding

repeation, these colemants have been nore difficult to propagate than the diploid vines of the same clone. This was especially true when using dermant contings. Aerial layers and soft-wood contings developed roots but generally failed to develop new shoot growth and become astablished. This was pronounced for propagations of these coloniploids that showed dwarfing like scuppernons, or were weak like forestil.

Produced not facken forther. Growth, yield, and quality of fruit at Clayton Williams and Jackens forther. Growth, yield, and quality of fruit at Clayton ware was good. This tetrarloid selection appeared to be monfrishedly oronising to be tested for possible release as a new randor. In 1955, a cropagation that is ade using 500 soft-wood outlings in various transcents. Similar tests were consided with digital from as liverage roother of both varieties was 91%, however, only 14% of the rooted entrings of 4x 20-30 produced thoot growth while 51% of the 2n Thomas oid. Of the intinger of No 4x 20-30 were the nursery in 1960, 56% or each wind survived but the plants of NO 4x 20-30 made an average growth of only two feet in comparison with four feet for the Thomas clants. The plants of ax NO 20-30 were very veriable in vigor, many bein very

Propegs one of many of the other colonipioids have been slow grow
"E, stunded diff cult to get estable acd, even those of which the
"iginal co" bloid has ocen vigorous. Many of these propagations have

"oot systems. It would appear that polyploid ciosue
"s and in the coloniploids, the vigor of the root and
"s proportion of polyploid tissue involved.

than similar diploid crosses, fewer seed have been obtained, germination has been low, growth of seedlings has been poor and slow, and survival has been poor. No seed were obtained from self-pollination in 1954, the first year the colchiploids were set in the field. This may have been due to severe 2-4-D injury which occurred at the time of full bloom. Seeds from open pollination were saved and grown. Those from the named varieties must have resulted from natural crossing since these varieties are pistillate. All the numbered selections are perfect-flowered and most of the seed of these may be from self-pollination but not necessarily so.

The lower germination of seed, and survival of seedlings and the slower growth of tetraploid seedlings are shown in Table 15. Some of the poor growth has been due to their inferior and stunted root systems which resembled the damage from sting nematodes in their short bunchy appearance, yet this condition was found when potting seedlings germinated in sterilized soil. With these poor roots many of the seedlings failed to get established in the nursery and either died or made only a few inches of growth. Many of these small plants were discarded after two or three years since they showed no indication of attaining fruiting size. In Table 16, the numbers of surviving plants are low, partly because of this elimination. The remaining seedlings were slow in beginning to bear fruit. It is possible that growth and fruitfulness of these was delayed until the slow growing roots reached better soil at lower depths (They were grown in a sandy location with a clay subsoil).

The top growth of many of the tetraploid seedlings has been dwarfed with short nodes and small leaves, and frequent formation of terminal buds. Others have had fair vigor and relatively large diameter canes. Attempts were made to overcome this dwarfing with sprays of gibberellin in 1957.

than similar diploid occase, fewer seed have been obtained, permination has been low, growth of meddings has been poor and slow, and marvical bas been poor. No seed were obtained from self-noilination in 1954, the first year the coloriploids were set in the . This may have been due to severe 2-4-2 injury which occurred at the time of full . Seed from open pollination were saved and grown. Those from the named varieties used have resulted from natural crossing since these varieties are pistillate. All the numbered selections are perfect-flowered and most of the seed of these may be from self-nollination but not necessarily.

The lower remination of seedlines are shown in Table. Some of the slower growth of tebraphoid seedlines are shown in Table. Some of the poor growth has been due to havir inferior and kinted root systems which resembled the damage from sting noratedes in their short brundy apparament, yet this condition was found when potting secolines germinated in starilized soil. With these poor roots many of the secolines feiled to get untablished in the morery and either died or made only a few kindes of growth. Many of these small plants were discarded after two or three years lines they show in or indication of attaining fruitting. In fitting the matters of surviving plants are low, martly because of this elimination. The remaining seedlings were slow to beginning to bear instituted in a law country of a reached better soil at lower depths (They were grown a sendy castion with a clay subsoil).

The top growth of my of the totraploid seedlings has been dwarmed . . . leaves, and frequent formation of terminal or . .

dwarfing with surays of theerellin in 1957.

Sprays were applied to arms on vines of the four colchiploid varieties that showed dwarfing and also to dwarfed tetraploid seedlings and to normal diploid plants. Treatments were made before and after buds started, when shoot growth had started and about one month later. No differences were observed as a result of these treatments.

By the end of 1959, only the more vigorous seedlings remained from the seed saved in 1954 and 1955. None had shown any promise over diploid plants even in berry size. In 1960, the seedlings of 4x Creek x open pollination set fruit and one of them, C72, ripened in late August, at least 6 weeks earlier than the diploid Creek variety. These berries were large, attractive and of excellent flavor and quality. Some of the other 4x Creek seedlings ripened in early September and had fruit of desirable size and quality.

These 4x Creek seedlings are the first of the muscadine tetraploids that have shown any promise. Two of these on the basis of 1 year of fruiting were suitable to consider for new varieties if they prove to be sufficiently productive and vigorous. It is possible that the true or fully tetraploid plants may be more usable in breeding and culture than the chimeral colchiploid ones; ie. they may propagate more easily and the microand megaspores may be more normal. For this reason several other tetraploid selections were saved from other crosses and selfings for testing and to use in breeding. These other tetraploid selections are good in every respect but no better than similar diploid ones. Their present value is for use in breeding, and for comparison with colchiploid plants.

The above tetraploid selections originated from seed saved at the McCullers Research Station. Seedlings from crosses made at the Clayton Research Station are presently growing in the field (Table 16). Only two

ere ied to arms on vices of the four coloniploid varieties

should diploid plants. Treatments were made before and after ouds started, not
shoot growth has started and about one month later. No differences were
observed as a result of these treatments.

By the end of 1979, only the more visarous seedlings remained from the end sayed in 1954 and . one had shown any promise over iplied plants ever in berry size. In 1960, the seedlings of 4x treek x open pullination set fruit and one of then, 072, ripened . later's ext, at least 6 weeks earlier than the diploid Greek variety. These berries were large, ettractive and of excellent Clavor and quality, some of the other 4x treek seedlings ripened in early September and had fruit of desirant size and uslit.

These 4x seek cedlings are the first of the anacadine tetraploids the have shown any promise. Two of these on the basis of 1 year of fraining were suitable to consider for new varieties if they prove to be sufficiently productive and vicorous. It is possible that the true or fully tetraploid plants may be more usable in preeding and ordinar than the unimeral coloniologo nes; is, they may propagate more easily and the micro-

es may be more normal. For this reason several other detraoid dections were saved from other crosses and self mas for testing
eding. ere other tetraphoid selections are good in
no better than similar diploid. Their present
use in broading, and for comparison with colchiploid plants.

selections selections originated from seed saved at the
effections originated from seed saved at the
effections originated from seed saved at the effection seed saved at the effections.

er inc e 'teld (Table 16). Only two

or three seedlings have fruited, and these have had large fine berries.

These tetraploid seedlings are from controlled crosses and should be of special interest in view of the performance of the Creek seedlings which resulted from open-pollination.

Triploids. Several crosses have been made in order to develop triploid plants. The reasons for these crosses were as follows. (1) could
this type cross be made, (2) would the progeny be sterile and set seedless
fruit, (3) would the progeny have the vigor usually associated with triploidy, (4) would doubling the chromosomes recover full fertility and retain
the vigor of the triploid, (5) would the progeny exhibit genome dominance
that might be used in breeding?

Most of the crosses were unsuccessful. In those completed, germination was poor and most of the surviving seedlings proved either to be not of the cross or diploid. No triploids were identified by chromosome count among the seedlings from open pollination of pistillate tetraploids. Only one triploid from the first crosses made, has been identified by chromosome count (NC 134-8). This vine, although of normal vigor, has set only an occasional berry of fair size and containing one or two seeds. Propagations of this triploid have been treated with colchicine. Two showed some indication in foliage of having been made hexaploid and are now growing in the vineyard at Clayton.

In 1959, sixteen crosses were made between tetraploid and diploid muscadines and 45 seedlings were grown (Table 16). These seedlings were treated with colchicine in 1960 and 7 were marked as having been doubled and 8 more as possibly being doubled. These are now in the Clayton vineyard.

The plants found to be hexaploid by cytological examination, have had deformed leaves, broad at the base and somewhat fan shaped, and veins

or three seculings have fruited, and these have had large fine....
There tetraploid seedlings are from someralled erosses and should be of special interest in view of the performance of the Greek seedlines which resulted from open-pollination.

Triploids. Several crosses have been made in order to levelop tricted of the cross less for these crosses were as follows. (1) could this type cross be made, (2) would the propert be attended to associated with their truit, (3) would the propert have the vigor usually associated with their oldy, (4) would doubling the chromosomes recover full fertility and retain the vigor of the triploid, (5) would the propert engage except exhibit genome deminance that might be used in breeding?

Most of the crosses were not recessful. In those completed, germination was poor and most of the surviving seedlings proved ither to be not of the cross or diploid. No ir ploids were identified by chromosome count among the secolings from open pollination of pishillate tetraploids. Only one tricloid from the first process made, has been identified by chromosome count (NG 132-8). This wine, although of normal vicer, has set only an occasional termy of fair size and continuing one or two secons. Propagations of this triploid have been treated with colabicing, wo showed some indication in feliage of having been made hereaploid and une showed some in the vineyard at May.

In 1959, sixteen grosses were gade betweeloted and ciploid muscedines and 45 seedlings were grown (Table 1. These seedlings were treated with colchicine in 1960 and 7 were marked as having been doubled and 8 more as rossibly being doubled. These are now in the Clayton vinsyard. These are now in the Clayton

which the same and the same and

have been thickened. Whether these deleterious effects will occur with all hexaploids, indicating the limit of ploidy, has not been determined. It is hoped that some normal appearing hexaploids will be found among this lot of seedlings when growth starts in the spring of 1961.

Conclusions. Only generalized conclusions can be drawn from the relatively limited use of these colchiploids as parents in crosses. However, they appear to differ among themselves in performance as parents more than similar diploid clones. Those classified as weak or dwarf in Table 12 have yielded few viable seed and their seedlings have been weaker than those of clones classified as vigorous. To date Creek and NC 20-30 have produced the most vigorous tetraploid seedlings.

When the colchicine treatments were made in 1954, the numbered clones selected were the best of which 10 propagations each were available for treatment. Even at that date there were more promising selections although the performance of any of them as parents was still unknown. Since then better selections (at the diploid level) have been found, some of which have produced promising progenies. Because some of the tetraploid seedlings appeared very promising in 1960, tetraploidy should be induced in the best of these newer selections, and various breeding combinations should be tried at the tetraploid level. It would be desirable to make those crosses that have been most promising at the diploid level. It would also be desirable to polyploidize some of the pistillate selections for seed parents in order to avoid the necessity of emasculation.

have been thinkened. ether these deleterious effects will occur with all beyonding indicating the imit of ploids has not been determined. It is hoped that some normal appearing heraploids will be found among this lot of seedlings when growth starts in the apring of ...

Conclusions. Only generalized comelusions can be drawn from the relatively limited use of these celchiploids as parents in crosses. However, they appear to differ smong themselves in performance as perents work than similar diploid clones. Those classified as weak or dwarf in lable 12 have piclass few viable send and their seedlines have been weaker than whose of clones classified as vigorous. To date Greak and NO 20-30 have procued the most vikorous tetraploid seedlings.

when the colehielme treatments were made in 1954, the numbered clones elected were the best of which it provagations each were available for irestment. Even at that date there were more promising selections although the performance of any of them as parents was still valuown. Chace then better selections (at the diploid level) have been found, some of which intwe moduced promising progenies. Hearnss some of he teiraploid reddlings appeared very promising in 1960, tetraploidy should be induced in the best appeared very promising in 1960, tetraploidy should be induced in the best tries as one mover selections, and various breading combinations should be tried as one tone word. It would be destrable to make trose crosses

The second state of the second second

The state of the s

III. HYBRIDIZATION WITH AMERICAN AND VINIFERA BUNCH GRAPES.

Muscadine grapes from Vitis rotundifolia are very resistant to most of the insect and disease troubles of other grapes. They are also very vigorous and productive. The berries are large, and well flavored in the improved varieties. Although the fruit clusters are generally smaller and more easily shattered than in other grapes, these could be characteristics of great importance for mechanical harvesting.

The desirability of obtaining hybrids between muscadine and bunch grapes has been recognized for over 100 years. Dr. Peter Wylie apparently was successful in obtaining a few hybrid seedlings about 1870 but these were lost. T. V. Munson believed he had obtained some hybrids from open pollinated seed of Scuppernong about 1900, but these are now known not to be species - hybrids.

Charles Dearing (1) obtained several true hybrids with vinifera and bunch grapes using V. rotundifolia as the seed parent. L. R. Detjen (7) and C. F. Williams (4) between 1912-1925 attempted crosses of V. rotundifolia with 15 species of Vitis and 11 species-hybrid varieties of Euvitis grapes. (Table 17). They obtained 2523 seed in crosses with 7 Euvitis species and with 6 varieties of Euvitis hybrids using V. rotundifolia as the male parent from which 353 seedlings were grown. Only four of the reciprocal crosses were successful from which 22 seed were obtained which produced 7 seedlings. Descriptions of only a few of these hybrids have been published but most of them were identified as true hybrids (8).

N. H. Loomis also obtained several hybrid seedlings from crosses between bunch grapes and V. rotundifolia but only when V. rotundifolia was used as the pollen parent.

TIT. HIGHTETATION WITH AMERICAN AND VINITUEN HUNCE GEARES.

whocatine grapus from Visis rotundifolis are very resistant to ment
of the insect and disease troubles of other re... They are also very
visorous and productive. The bentine are large, and well thavered the
improved varieties. Although the fruit element are ponerally smaller and
more easily shattered that is other grapus, these could be characteristics
of great importance for mechanical harmanting.

h desirability of abbairing hybrids between massadine and bonds grapes has been recognised for over 100 year. r. Feter Wylis apparently was successful in attaining a new provid seedling about 1870 but these were lost. . . numson believed he had abtained some hybrids from open pollinated seed of Samppernong about 1900, but these are now known had to be species. Ayorics.

Churles Dearing (1) obtained several time hyprids with winifers and brunch propes using . rotandifolis as the seed perent. . . Letjen (7) and . . Williams (4) between 1912-1915 attempted prosses of . rotundinfolis with 15 species of withs and 11 species-hybric variation of buvitis species (7sble 27). They obtained 2522 seed in prosses with 7 invitis species

and with 6 variaties of witis by orids sing, rotmodifolis as the male parent from which 35% seedlings were grow. Only four of the reciprocal crosses were successful from which 27 seed with outside which produce 7 seedlings, descriptions of only a few or those hybrids have been published but most of them were identified as true wirriss (8).

 Many of the hybrid seedlings in the above species-crosses by Detjen and Williams, were staminate and the rest were almost completely sterile.

No seed were obtained from self-pollination of the F1 hybrids and only one seed from sib-crosses (Table 18). A few seed were obtained in back-crosses from which 8 seedlings were grown; 6 in back crosses to V. rotundifolia and 2 to V. vinifera. A few of the F1 hybrids occasionally set a few berries from open-pollination and 85 seed obtained in this manner produced 5 plants. These were probably back-crosses to V. rotundifolia because of pollen availability. All these second generation plants were weak; most of them dying the first year and none reaching flowering age.

The following F1 clones, from this species-hybridization between 1910-1930, are now growing at the N. C. Experiment Station (1960).

NC 6-15 Malaga x V. rotundifolia

NC 6-16 Malaga x V. rotundifolia

B 4-5 Scuppernong x Louisiana

Progenies of NC 6-15 and NC 6-16. Propagations of NC 6-15 and NC 6-16 were made available in 1938 to R. L. Farrer, a private grape breeder in Atlanta, Georgia. In 1960 he reported that in 1941, 1944 and 1945 he had grown 20 seedlings with NC 6-15 as the pistillate parent (9). It is not clear whether all were the result of crosses with bunch grape pollen, but some controlled crosses with Euvitis varieties were attempted. Of the 20 seedlings grown, 7 were intermediate in appearance, the rest were more like V. rotundifolia although he knew of no available V. rotundifolia pollen. One (F21) resulted from a cross with V. cinerea. Only 6 plants were pistillate and one was perfect-flowered. All were described as normal in vigor. Some of these plants bore a few berries in some years. Plants from these open-pollinated berries were vigorous but unproductive and lacking in quality. Robert Dunstan, a private breeder in Greensboro, N. C., obtained a fertile hybrid (DRX 55) from open-pollination of NC 6-15, probably a back-cross with Euvitis. From

Many of the hybric seed for in the shows species-crosses of redjen and Williams, ere staming to and the rust were almost complication.

No seed were obtained from self-politication of the Pg hybrids and only one seed from rib-crosses (Pable . A few acad were obtained in tack-crosses from which E seed fine from the Pt hybrids occasionally not a few benies and 2 to . winterm. A few of the Pt hybrids occasionally not a few benies from appropriation and 25 and obtained in this sunner produced ? There were probably back-crosses to . Counds of the Store were probably back-crosses to . Counds of the second generation plants were weak; most or them aying ability. All these second generation plants were weak; most or them aying the first year and none resenter flowering .

The following F7 clones, from this species-hybridization between 191 -

NC -15 Malaga x . rotundifolis

NO 6-16 . Melaga x . retundifolia

B 4-5 Seurgernoug x Louisiana

this fertile hybrid he has grown 300 seedlings from crosses with Euvitis varieties. He has other seedlings from crosses of NC 6-15 x bunch grape.

Many of the seedlings in these Dunstan crosses are vigorous and more disease resistant than adjacent Euvitis seedlings. Several are fertile.

In Raleigh, NC 6-15 (2n) has set fruit only occasionally. In 1954 several berries developed from open-pollination, probably with V. rotundifolia (Table 19). From these berries, 52 sound (non-floating) seed were saved of which 24 germinated. Only 12 seedlings were planted in the field. Seven of these have survived and have fair vigor. Seeds from open-pollination of 5 of these were saved in 1959 (probably x V. rotundifolia). At present 200 seedlings are in the nursery at Clayton, N. C.

In 1960, crosses were attempted between these open-pollinated seedlings of NC 6-15 (2n) and Euvitis varieties, muscadine selections, sibs and selfs. Seed were obtained in the crosses with muscadine pollen, one vine set seed in a sib-cross and one vine set seed with self-pollination (Table 19).

No berries have set on NC 6-15 (2n) since 1954. The plants were badly injured by a late freeze in 1955 and moved to the new Research Station at Clayton, N. C. in 1956. The canes were killed back by cold in 1958 and 1959. In 1960, two vines bore a small crop of flowers but no berries developed from crosses with Euvitis or muscadine pollen, or from open-pollination.

Dermen induced fertility in the partially sterile N^{C} 6-15 and sterile N^{C} 6-16 by chromosome doubling with colchicine (5). He obtained seed from open pollination of N^{C} 6-15 (4x) and from the pollination of N^{C} 6-15 (4x) x N^{C} 6-16 (4x) (Table 20). At Raleigh in 1960, seed were obtained by selfing N^{C} 6-16 (4x) but not N^{C} 6-15 (4x). N^{C} 6-15 (4x) set seed when pollinated by N^{C} 6-16 (4x), and both set seed when pollinated by N^{C} 6-16 (4x). Pollination with pollen of tetraploid varieties of N^{C} 7. Totundifolia was not tried but the reciprocal cross Creek (4x) x N^{C} 6-16 (4x) was unsuccessful.

this tills typined he has grown 300 smadlings from arrance with Davible varieties. He was other wedlings from erosess of NJ -15 a banch grape. Many of the seedlings in less hastan crosses are vivocous and more discase resistant than adjacent dowitis . Several arc fertile.

In Releigh, NO 6-15 (2n) has not fruit only observably. In 1954 several beinies developed from open-pollination, probably with a rotundifolia (Table). From those perries, 52 sound (non-floating) seed were saved of which 24 remainshed. Only 12 seedlings were planted in the figure of these have survived and have feit vigor. Seeds from quen-pollination of 5 of those were saved in 1959 (probably v. rotundifolia). At present 200 seedlings are in the nursery at Tityton.

In 1960, crosses were attempted between these open-pollinated stallings of VC 6-15 (2m) and Duvitis variaties, amecadine selections, rios and seed were obtained to the grouses with toscadine collen, one wine set seed in a sib-cross and me vine set seed with self-pollination (Table).

No nervies have not on NC 6-15 (2n) since ... The plants were badly injured by a late treate in 1955 and moved to the new Research Station at layion, ... in 1956. The cames were killed back by only in 1958 and 1959. In 1960, two vines bore a small crop of flowers but no certics developed from crosses with britis winecediae poller. or from or n-pollination.

Dermen induced 'ortility in the partially storile N° 6-15 and storile 6-16 by chromosome cubling 6th collection. '. He obtained seed from composition of N° -15 (4x) x composition of N° -15 (4x) x composition of N° -15 (4x) x collection of N° -15 (4x) and collection collect

. rote of a was not tried but so represented and some first and belief

129 seedlings from open-pollination of NC 6-15 (4x) showed little variability in growth or leaf characteristics in 1960 after a year in the vineyard. Seven seedlings from NC 6-15 (4x) x NC 6-16 (4x) were quite variable in vigor, and lobing and shape of leaves.

Thus of the F1 species hybrids resulting from crosses of 1910 to 1925, one selection, NC 6-15 (2n) has been partially fertile and has occasionally set seed in controlled crosses and by open-pollination. Some of the second generation progeny have also been fertile. NC 6-15 (2n) at Raleigh, has not been completely hardy and in many years the canes are cold damaged or killed back to the trunk. This may account for some of the irregularity in fruiting. Vines of NC 6-15 (2n) at the present time are susceptible to black rot and mildew and are frequently defoliated in mid summer. Whether these are the same strains of the fungi that infect V. rotundifolia or the strains that infect Euvitis species is not known (If there is difference in strains). The berries which are developed are usually single seeded and too small to tell much about fruit qualities.

The seedlings of NC 6-15 (2n) in Raleigh resulting from open-pollination, presumably with V. rotundifolia pollen, have been much more susceptible to black rot and mildew than V. rotundifolia, less vigorous and productive than this species and not completely winter hardy. The seedlings from open-pollination of these selections are very susceptible to leaf spot from black rot. On the other hand, Mr. Dunstan's seedlings of NC 6-15 (2n) open and cross pollinated with Euvitis pollen have been more disease resistant than Euvitis vines adjacent to them.

It would appear that NC 6-15 (2n) does not carry sufficient genes from V. rotundifolia for disease resistance which would be one of the main objectives of this species-cross. However, NC 6-15 does indicate that some degree of fertility can be obtained in the F₁ at the diploid level, and more

129 seedlings from open-pollinetic of WG - (Ax) showed little variability in quark or lest characteristics in 1960 after a year in the vineyard. Seven seedlings from UC 6-15 (Ax) x NC - (Ax) were quite variable in vigor, and lowing and shape of leaves.

True of the Equation hyporide resulting from encered of 1910 to 1975, one selection, AC 6-15 (2n) has been partially forth, and has conscionally set seed in controlled crosses and by over-pollination. Tome of the scenar generation projectly have also been fertile. NC 6-15 (2n) at maleigh, has not been completely hardy and in many years the cenes are cold damages or killed been completely hardy and in many years the cenes are cold damages or killed been completely hardy and in many the irregularity in fruiting. Vines of LC c-15 (2n) at the present time are susceptible to clack rot and milder and are frequently refutated in this summer. Whether there are the same strains of the fragit that infect and this summer, whether there is called the decided of the strains that infect much about the that move of the greater that move of the section are nevel oped are usually single second and one mail to tell much about fruit qualities.

The seculings of NG (-15 (2m) in heleigh resulting from open-pollination, oresumably with a roundifolis pollen, have been much more susceptible to black not and miles than a roundifoli. less vigorous and productive than this species and not completely winter hardy. The sections from open-pollination of these selections are very susceptible to less spot from black not. In the other hand, Mr. Dunstan's sections of NC (-15 (2m)) open and cross pollinated with Envills pollen have been more disease registed than Envites viner adjacent to them.

The world appear that WG (-15 (2n) does not carry sufficient sense from V. rotundifolia for I sase recistance which would be one of the main

when the F₁ hybrid is made tetraploid. Different parentage for the first cross, transmitting greater resistance of V. rotundifolia and more fruit quality of Euvitis would be desirable. If such parents which are compatible cannot be found, NC 6-15 itself may serve as a bridge to overcome the sterility barriers. Cytological studies would be very helpful in determining the specific difficulties involved and in indicating possible means of solving them.

Present Program of Species Hybridization

Autopolyploids. The first tetraploid muscadine grapes from chromosome doubling by Dermen were planted in Raleigh, N. C. in 1954 and came into bloom that year. No tetraploid vines of bunch grapes were available for use as pistillate parents but pollen of tetraploid bunch grape varieties was obtained from Beltsville, Md., and used on the 4x muscadine varieties. No berries were set in any of 15 different crosses attempted (Table 21). Dermen also had negative results from similar crosses in 1954 with muscadine selections as the pistillate parents.

In 1955 small propagations of Niagara (4x) bloomed in the greenhouse but failed to set fruit with pollen from tetraploid muscadine selections. In 1956, six of ten crosses produced 74 seed from which 29 seedlings were grown, none of which were hybrid. In 1957, no seed were obtained from four crosses with 4x bunch grapes as the seed parents and none in 12 crosses with them as the pollen parents. In 1958, five crosses were tried but only one seedling resulted from a cross with Franklin (4x). In 1959, crosses were tried on eight tetraploid bunch grapes which produced 288 good seed all but four of which were from crosses with the male sterile Franklin (4x). An equal number of light seed also developed. Only 41 of the 288 seed germinated. Many of the seedlings were weak and only 28 were planted in the nursery. On

when the F, tria is made tetraploid. Different parentage for the Piret cross, beansmitting preater resistance of . robundifolis and now fruit quality of their world be desirable. If such parents which are computed cannot be found, WC 6-15 itself may serve as a bridge to overcome the startity barriers. Sytological studies would be very helpful in determining the specific difficulties involved and in judicating possible means of solving.

Present Program of species Hybridization

interpolyrial. The first betraploid muscadine grapes from chromosome doubling by Dermer were planted in Heleigh, . . in 1954 and came into bloom that year. No tetraploid vines of buner grapes were available for use as nistillate parents but poller of tetraploid buneh grape variaties was obtained from feltsvill, Md., and used on the 4x muscadine variaties. No berries were set in any of 15 different crosses attempted (Isble 1). Hermen also had negative results from similar crosses in 1954 with muscadine selections as the pistillate parents.

In 1955 and I propagations of diagera (1) bloomed in the processions. but feiled to set fruit with wollen from setraploid emscadine selections. In 1956, six of ten prosses moduced 74 seed from which 29 seellings were crosses with 4x bunch wrips as the seed perents and some in 12 grosses with them as the nollen parents. In 1958, five crosses were tried out only one seedling resulted from a cross with franklin (4). In 1959, crosses were from or significant from the male sterile limitin (1). An four of which were from or a with the male sterile limitin (13). An four of which were from or a with the male sterile limitin (13). An four of the seedlings we a tonly 22 were planted in the nursery. On Many of the seedlings we at only 22 were planted in the nursery. On

vines were not clearly defined which would indicate possible hybridity.

Thus crosses at the tetraploid level between bunch and muscadine grapes have produced few if any true hybrids. Crosses between tetraploids of other genera have been reported as being more difficult than similar diploid crosses. However, in the present case only a limited number of varieties have been tried as parents, and even at the diploid level many crosses have failed. More tetraploid varieties should be tried. This would be easier and many more pollinations could be made with less damage to flowers if pistillate varieties were used as the seed parents. Rarely is a good set of fruit developed on emasculated clusters. Damage to pistils and pedicels in mainpulation is severe. In addition considerable unwanted pollination during the operation is almost inevitable. It would be advisable to make a cytological examination of flowers and pollen of the proposed parents. A high percentage of the pollen from some colchicine produced tetraploids has been non viable.

Allopolyploids. Crosses between bunch and muscadine grapes at the diploid level have produced some diploid hybrids in the past and have done so in the current program (Table 22). In North Carolina, 8 diploid species crosses were unsuccessful in 1957 and 9 in 1958. In 1959, however, 753 sound seed were obtained in 15 of 18 crosses tried and 187 plants were grown. Only 57 of these were identified as true species-hybrids of which 54 were from crosses with Golden Muscat. There was one each in crosses with Fredonia, Niagara and Lutie, none in crosses with Concord or S.V. 12-375. These diploid hybrids were treated with colchicine in 1960 and 47 were moved to the vineyard in October. It is believed that chromosomes were doubled at least in 18 vines and that more vines with tetraploid shoots may be identified in 1961 after growth starts. One seedling, NC 226-11, (Golden Muscat x NC 60-60), produced a cluster of 32 berries on a tetraploid cane after treatment. These

vines were not clearly refined wrich would instructe costible bybridity.

Thus prospect at the 'entraploid level between wanch and masce inc stages have prospect 'en if any true 'yorids, Cross as between tetraploids of other remere 'who beer respect as being more difficult than staffar ciploid process. However, in the present case only a lighted amber of variaties have been tried at parents, and even at the Hilloid level new crosses have failed. Fore titraploid varieties should be tried. This would be easier and many more politications could be made with less damage to illowers it distillate varieties were used as the seed parents. Markey is a good set of fruit develored or emasculated clusters. Damage to pistils and politicists in mainfulation is severe. In addition considerable may red politation curing cytological examination of flowers and politic of the original parents. A high percentage of the pollen from some colonidue or endouced betraploidue has been con riable.

Allowalysicide, mosses between hunch and muse address at the diploid level have produced some siploid hybrids in the past and have come as in the course program (Table 22). In worth Garoline, 2 milloid species crosses were mean caseful in 1957 and o in 10 to 10 to

. The same of the

berries matured in late November 1960 and were of good size (3.8 grams each), averaged 22.5% total soluble solids and had • very fine aromatic flavor.

In 1960, a cross of (2n) Van Buren x (2n) NC 27-262 produced 131 seed.

In 1958, Dermen at Beltsville, obtained 708 seed from 6 diploid species crosses. These were planted at the N. C. Experiment Station in Raleigh and 301 plants grown and treated with colchicine and later 183 were planted in the vineyard. These were examined, cut back, etc. during 1960 and in October 145 were believed to be true hybrids of which probably 58 were successfully doubled.

Any of the species-hybrids from the colchicine treatments of 1959 and 1960 that are of interest because of vigor, plant characteristics, etc. but have not been successfully doubled should be retreated in 1961.

Triploids and Hexaploids. Several of the tetraploid muscadine plants developed in 1953 by Dermen with colchicine treatment were stunted and dwarfed. Many of the rooted propagations of the colchiploid plants have been slow growing and stunted. A high percentage of the seedlings from crosses and from open pollination of these original colchiploid muscadines has been slow growing and stunted. Poor growth habit has been reported as a fault of many tetraploid plants.

In contrast to this poor growth, triploid plants of other genera are often more vigorous than the diploid forms. Triploid plants are frequently sterile and unproductive but not necessarily so. It should be possible to regain fertility by doubling the chromosome number and it might be possible to do this without loss in vigor or good growth habit. Such hexaploid plants might make desirable selections themselves, or by crossing them with diploid plants, fertile tetraploids might result. From the uneven number of chromosome compliments, it should be possible to obtain progenies with genome dominance from either species parent in varying ratios.

berries wa ured in late Northber 1960 and the good size . grams each), sveraged 22.5% total soluble solids and had a very fine aromatic .

In 260, a eross of (20) Van Surence (2n) wil 174-262 produced 131

To 1955, Dermen at elegability, outsined 708 eest from Chiploid spectorosses. These were planted at the . Experiment Station in Maleigh and Oll plants grown and breated with collenioine and Said Taker 123 were planted in the vineyard. These were examined, out back, . during 1960 and in October 144 were believed to be true hybrids of which probably 50 were successfully double.

Any of the species-hybrids from the colonicine treatments of 1950 and 1960 that are of interest bacamee of vicor, plant characteristics, in have not been successfully doubled should be retreated in 1061.

Principles and Mexaploids, several of the terraphote macadine plants developed: 1957 by Lermen with colchicine treatment were sturted and dwarfed. Many of the rooted propagations of the colchiploid plants have been slow growing ing and the seedlings from crosses and from open pollination of these original colchiploid muscalines has seen slow growing and stunted. Our growth habit has been reported as a fault of many tetracion plants.

In converse to this your prowth, triploid plants of other peneme are often more vigorous than the diploid forms. Indepod oftents are fraggently sterils and unproductive but not necessarily. It should be nossible regain fertility by doubling the chromosome number and i might be cossible to do this without loss in vivor or good growth . Ench heraploid plants might make desiran section here alves, or by erossing them with diploid might make desiran section here alves, or by erossing them with diploid of the components.

the state of the s

- The state of the same and the same

In 1959 three tetraploid bunch grape varieties were pollinated with pollen from three different diploid muscadine selections (Table 23). Very few seed were obtained from crosses on perfect flowered Dakota (4x) and Champanel (4x) which had to be emasculated and these seed failed to germinate. A good set of seed (761) developed on the male sterile Franklin (4x). A large number of light seed (floaters) was discarded.

Reciprocal crosses using pollen of M6-4A (4x) on 6 different diploid Euvitis varieties produced sound seed in each cross. However, the seedlings from these were identified as being entirely Euvitis and were discarded. These may have resulted from contamination or from cleistogamy which is known to occur in Euvitis. Some of the light seed and non-viable seed may have resulted from the true cross.

Germination of the seed in the crosses between tetraploid Franklin and diploid Muscadine selections was low and only 90 plants were produced. These were very vigorous and cytological examination showed them to be triploid. Intermediate morphological characters including absence of diaphrams at the modes confirmed that they were species hybrids.

These triploid species-hybrids were treated with colchicine. Penetration of the colchicine to the growing point in the buds of Franklin seed-lings was difficult although the bud leaves developed mosaic patterns.

(Less difficulty was encountered with seedlings of the other bunch grape varieties) A second treatment with removal of the bud scales and use of a cotton pad was more effective. Probable hexaploid shoots developed on 10 plants. It is hoped that more can be found when other buds grow in the spring of 1961. Foliage on shoots identified cytologically as having hexaploid tissue was abnormal and distorted with thick margins. Shoot tips and buds on some plants dried out, making cytological counts impossible. While these abnormalities may have indicated the limits of polyploidy,

In 1959 three tetralicid ounch grape veristion were collinated etc.

pollen from three different diploid muscadine selections (lable 19). Very

fer seed were obtained from crosses on perfect flowered Dakota (ix) and

Champenel (ix) which had to be emasculated and these seed failed to germinate.

A good set of seed (761) developed on the male starila Franklin (ix). A

large mader of light seed (floaters) was discarred.

Reciprocal crosses using collen of - (Ax) on 6 different diploid nuvities varieties produced sound seed in each . However, the seedlings from these were identified as being entirely havitis and were discarded. These may have resulted from contamination or from eleistogram which is known to occur in Euvitis. Some of the light seed and non-viet seed may have resulted from the true cross.

Germination of the seed in the crosses between tetraploid respiling and diploid Muscautine selections was low and only 90 plants were.

These were very virorous and sythological examination showed them to a ploid. Intermediate morphological characters including absence of disphrens at the modes confirmed that the were species mythics.

These briploid species hybrids were brested with collabiline, centration of the adiabiline to the growing point in the onds of specimentalines was difficult although the bud leaves developed mean's pathenes.

(Less difficulty was encountered with specifies of the other comes grape varieties) a second breatment with removal of the ind scales and use of a cortan pad was more affective. Probable hemaploid shoots developed on a cortan pad was more affective. Probable hemaploid shoots developed on 10 plants. It is hoped that more can be found when other bude grow in the apring a 1961. Folities on shoots identified (tologically as having the apring a 1961. Folities on shoots identified (tologically as having

--- In the state of the state o

- to are an added to a property of the color of the color

it is believed that other plants were doubled without exhibiting any serious defect. The growth in 1961 should be carefully watched and examined for more hexaploids.

In 1960 a cross of 2n Golden Muscat x (4x) NC 20-30 produced 82 seed.

A similar cross with Van Buren failed to set any seed.

An inventory of the species-hybrid material at North Carolina Experiment Station, January 1, 1961, is given in Table 24.

Conclusions. Work has not progressed far enough in the hybridization of bunch and muscadine grapes to indicate how successful this will be toward the development of fertile hybrids. The need is great and its value to grape breeding and the grape industry would extend to all grape growing regions.

Several problems have been encountered. Species crosses have been difficult and unilateral at the diploid level and appear to be even more difficult at the tetraploid level. Combinations of more and different parents at both diploid and tetraploid levels should be tried in order to find compatable parents. These should be of the best available genetic material possible.

The number of present tetraploid varieties is limited and many of the best varieties of bunch, vinifera, and muscadine grapes are not available in tetraploid form. More of the best varieties of the various species should be treated and made available as tetraploids for breeding.

Where possible, pistillate (male sterile) parents should be selected for seed parents to avoid the difficulties and injuries of emasculation. This alone could increase the number of pollinations 1000 times and reduce the hazards to floral parts. Use of hormones in all crosses might increase the retention of flowers, fertilization and set of seed.

it is believed that other plants were corried without exhibiting any serious effect. The prowth in 1901 should be correctelly watched and examined for core hexanloids.

The 1960 persons of the Golden Mascat re (Ax) NC 20-30 produced 92 sand.
A similar arms with Van Auren of the to set any seed.

In inventory of the species-hybrid material at corth Carolina Experiment Station, January 1, 1961, is given in Table "...

Conclusions work has not progressed for enough in the hybridization of onurb and muscadine grapes to indicate now successful this will be toward the development of fertile hybrids. The need is great and its value to grape orocding and the grape industry would extend to all grape enoting .

Several problems have been encountered. Species cruses a have been wifficult and unilateral at the diploid level and appear to be even more difficult at the tetraploid level. Combinations of more and different parents at both diploid and tetraploid levels should be at the Lest available genetic material rossible.

The number of present tetraploid varieties is lighted and many of the best varieties of bunch, winifers, and susceding grapes are not available in totraploid form. More of the best varieties of the various species should be treated and made available as tetraploids for breeding.

Where possible, pistillate (male sterile) parents should be salected for seed parents to avoid the difficulties and injuries of emasculation.

This alone could increase the number of pollinations 1000 times and record the maxards to it alone to hormones in all crosses might increase the maxards to it as seed hormones in all crosses might increase

Most seedlings in tetraploid crosses have been weak and slow growing, and many have been dwarf. Certain muscadine parents as Creek and NC 20-30 have had more vigorous progenies than other parents. Perhaps parental combinations can be found which will yield seedlings with good growth habits at the tetraploid level.

Making the species cross between diploids for subsequent doubling to allophoyploids would make possible a wider selection of parentage immediately and would probably yield a larger number of F₁ hybrid seedlings. However, the number of individual plants to be treated with colchicine and identified as 4x would be greatly increased, and the routine identification of tetraploidy in colchicine treated species-hybrid seedlings has been difficult without comparable clonal hybrid material. Further generations of breeding would have to be at the tetraploid level with its related problems.

Because pistillate varieties and selections of high quality muscadine grapes are available, many more crosses with this species as the seed parent should be tried. Dearing obtained some F1 hybrids in such crosses using pollen shipped long distances. Many combinations could be tried with comparatively little effort. Flowering dates of different species would more nearly coincide.

Because of possibilities from genome dominance in tetraploids and hexaploids such crosses should be attempted.

have had more vigorous progenies than other parents. Technos parental combinations can be found which will yield seedlings with good growth habits at the tetraploid level.

and the second s

Making the species of selection subsequent dendling to all applyphoids would make possible a wider selection of parentage immediately and would probably yield a larger number of Hy hybrid seculings. However, the number of individual plants to be treated with colemicine and identified as 4x would be greatly increased, and the routine identification of interpoloidy in colemicine treated species—nybrid secilings has been difficult without comparable closed hybrid material. Further generations of proeding would have to be at the tetraploid level with its related problems.

Because pistillate verieties and salections of high quality emecacine grapes are available, many more crosses with this questes as the seed perent should be rind. Learing obtained some by hybrids in such crosses using pollon shipped long distances. Many combined one could be tried with comparatively little offert. Flowering lates of different species would were paratively little offert.

Lecause of possibilities from genome dominance in tetrerloids and heraploids such crosses should be attempted.

and the second terms for a filter to the second to the second terms of the second term

Literature Cited

1.	Dearing, Charles. 1917. Muscadine grape breeding. Jour. Heredity
	IV 409-427.
2.	1918. The production of self-fertile muscadine grapes.
	Proc. Am. Soc. Hort. Sci., 14: 30-40.
3.	. 1948. New muscadine grapes. USDA Cir. 769.
4.	Dermen, Haig. 1954. Colchiploidy in grapes. Jour. Heredity XLV:
	159–172.
5.	. 1958. Sterile hybrid grape made fertile with colchicine
	Fruit Varieties and Hort. Digest. 12: 34-36.
6.	Detjen, L. R. 1917. Inheritance of sex in Vitis rotundifolia. N. C.
	Agr. Expt. Sta. Tech. Bul. 12.
7.	. 1919. Limits of hybridization of <u>Vitis rotundifolia</u>
	with related species and genera. N. C. Tech. Bul. 17.
8.	1919. Some F ₁ hybrids of <u>Vitis rotundifolia</u> with related
	species and genera. N. C. Tech. Bul. 18.
9.	Farrar, R. L. 1960. Correspondence.
LO.	Loomis, N. H. 1948. A note on inheritance of flower type in muscadin
	grapes. Proc. Am. Soc. Hort. Sci., 52: 276-278.
11.	, C. F. Williams, M. M. Murphy. 1954. Inheritance of flower
	types in muscadine grapes. Proc. Am. Soc. Hort. Sci., 64: 279-
	285•
12.	, C. F. Williams. 1957. A new genetic flower-type of
	muscadine grape. Jour. Hered., 48: 294.
13.	Williams, C. F. 1923. Hybridization of Vitis rotundifolia. Inher-
	itance of anatomical stem characters. N. C. Tech. 23.
14.	1926. Muscadine grape breeding and hybridization at the
	North Carolina Experiment Station. So. Agi. Worker's Meeting,
	Atlanta. Not published.

Literature Cited

Desring, Carelon, 1917, Anscarine grape broeding, Jour, Heredity	* "
1918. The production of self-ferbile masuadine	
. 1~ ° 21 . to ' . to '	
. Ill . New mecadine marcs. WSD: ir.	
Carmen, Raige Colemploidy in Jour, Heredity LIV:	-
. 1950. Sterile bybrid grame made fertila with colobining	ъ
ruit Varieties and Hort.	
etjon,	6
egr Sta. Jerb. Bri. T.	
effoltioneor aitil to notisethindy to ethnic	*
with related species and genera. N "ech. Lal. 7.	
- 1919. Some 24 hybrids t Vibis relaminifults with related	•
spacies and recre eco. w.	
Parrar, . 1. 1960. Gerrespondence.	
Loomis, 1948. A note on inheritance of flower type in muscadine	15
, '`_ ' (82 , to	
P. Williams, Marchy, 1974. Tahurttence of flower	A
types in muscadine crapes ort	
o eart-rower of the answer of the searching of	*
muscadine rrape, imr 48: "!.	
williams, 102. Whridtastion of litis rotundifolis. Inher-	, CT
itance of anatomical stem characters Tech. 17.	
. 1976. Museadine grape breeding and hypridization at the	. 1
North Carolina experiment : tetion, :o dorker's Heeting,	
Ablant. Not published.	

Literature Cited (continued)

- 15. Williams, C. F. 1954. Breeding perfect-flowered muscadine grapes.

 Proc. Am. Soc. Hort. Sci., 64: 274-278.
- 16. ______ 1957. Relation of berry size to flower type in seedlings from muscadine grape crosses. Proc. Am. Soc. Hort. Sci., 69: pp 254-260.

. 'ns, (), . 'os). 'reding perfest lowered muscadine graphs.

1957. Helation of perry size to flower type in seed-

69; pp 254-260, 200

Table 1 74

Total a Mountain

Don't be

Creavell 15 April November Nov Rater Parties of Spring

utra 00 1997

During (perfect-flavored)

Introduced in 1953 by M.

Leaste My Magous (perfequellaserus)

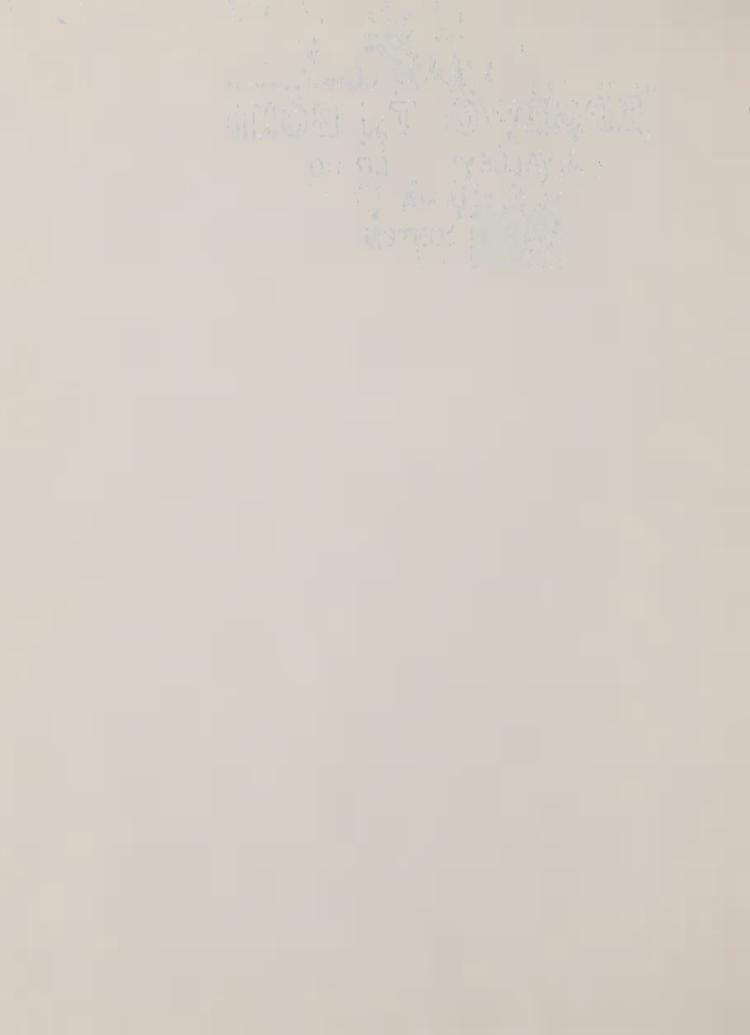


Table 1

New varieties originated in the Muscadine grape breeding program

Introduced in 1945 by Dearing

Perfect-flowered varieties	Pistillate varieties
Burgaw Duplin Pender Tarheel Wallace Willard	Cape Fear Orton Creswell Stanford Kilgore Topsail Morrison New River Onslow
Introduced in 1957	Dearing (perfect-flowered)
Introduced in 1959 by N. H. Loomis	Magoon (perfect-flowered)

they've so a West American

Muscadine Grape Crosses (diploid)

Selections

Remarks

T96T

496T

Snd

ts[.

Parentage

Plants

	Sub-acid, good, dry scar, tough	Acid, fair, tough, black rot, defoliated	poor,	Poor flavor, defoliated	Fair-good, mild, sweet, cluster, vigorous	Acid, fair, oval, dull, med, large	musky, fair foliage	good flavor,	dull, fair, mid late, wet scar	igorous, swe	Good flavor, sweet, early, dull, tough, dry scar		Mild, insipid, med. early, soft, cluster	Acid, musky, tough	Very good flavor, tough, shell	Good, even ripe, vigorous, good foliage, cluster	Poor flavor, bad foliage, tough, shell	Fair-good, shell	Fair, sub-acid, dull, oval, tough	Attractive, poor flavor, oval, late	Sub-acid, good, tough, dry scar	Fair, poor foliage				small, oval, late, yellow,	
	0	0	0	0	H	0	0	3	0	3	m	0	Н	0	0	N	0	0	0	0	Н	0	0	0	0	0	
	0	0	0	0	n	Н	0	7	-	3	3	H	3	0	0	N	0	H	Н	-	H	0	0	0	0	0	
	N	0	Н	0	7	m	0	7	m	5	5	H	7	-	H	50	0	N	N	N	Н	H	0	0	0	0	
	9	ri	3	m	10	∞	N	10	00	16	0	W	17	10	7	10	0	3	4	7	m	Н	0	0	0	0	
	105	101	253	59	138	86	79	332	107	198	349	102	207	132	128	238	281	113	174	124	78	123	31	777	35	N	
	Burgaw	Wallace	Willard	Pender	Tarheel	Duplin	6-52	Burgaw	Wallace	Tarheel	Burgaw	Wallace	Tarheel	Wallace	Burgaw	Tarheel	Burgaw	Burgaw	Wallace	Tarheel	Self	Self	Self	Self	Self	Self	
9761	Scupp.	=	=	=	=	=	=	Topsail	-		Latham	=	=	Thomas	Qua Qua	=	Mish	Cape Fear			Burgaw	Wallace	Tarheel	Willard	Pender	Duplin	
	Н	N	m	7	2	9	₩	0	10	11	12	16	17	18	19	20	77	22	23	24							

T9

45

stas

Selections

Remarks										Sweet, fair, even ribe, black rot		Vigor, good flavor, fair, large, late	Vigor, acid, poor, black rot, large, late	Even, good flavor, sub-acid, dry scar	Acid, poor, smooth skin, black rot	Poor	Poor, shell	Good flavor, high sugar, small, early									
6t										-	0	7	-	5	0	0	0	7	0								
6T											0	7	H	2	0	0	0	2	0								
υŻ										2	0	0	-	13	N	0	0	10	0								
sī	0	0	0	0	0	0	0	0			e	39	77	57	00	10	-	15	9	0	0	0	0	0	0	0	
Id	128	4	57	82	67	22	14	10		76	31	412	162	255	131	199	81	135	118	56	13	27	-	25	15	99	
9	Self	Self	Self	Self	Self	Self	Self			Burgaw	Wallace	Burgaw	Wallace	Burgaw	Wallace	Burgaw	Wallace	Burgaw	Wallace	Self	=	der des	=		=	=	
Parentage	3-B8	11-B8	5-B8	88-B6	94-B6	55-B6	61A-B6	99-B6	79.77	Hunt	=	Lucida	=	Creswell	=	Smith	=	V21 R15 B2	=	Pender	11-B8	5-B8	56-B6	88-B6	99-B6	94-B6	
										25	26	27	28	53	30	31	32	33	34								

Table 2 (continued)

		ic.	lavor, even, ren, vigor tender	large, black rot, black rot, poor et, tender
Not productive,	Not of cross Black rot, toug	Melting pulp,	Cluster, good i Sweet, good, ev Sub-acid, good, Sweet, tender Musky	Not early, not lan Not productive, bl Thin skin, sweet, Thin skin, sweet, Even, fair, acid, Vigor, resistant,
00	00	0	000000	000000
00	00	N	онопо	0000000
00	00	7	4611260	000000
0 1	1	0040	100 118	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
177	°44°	1227	289 221 116 90 97	24.3
Burgaw	Wallace Burgaw 25-84	G-52 Burgaw Self	G-52 37-10-1 G-52 37-10-1 G-52 37-10-1	Burgaw 9-199 11101 25-8-4 37-11-1 5-109 Self
1948 Beaufort	Orton 54-B6 Topsail	Latham Smith Duplin Tarheel	1949 Thomas Scupp. 25-8-26	1950 Memory Beaufort Scupp. " " Topsail
35	38833	077	254545	273 270 28
	1948 Beaufort Burgaw 14 0 0 0 Not productive, weak, "Wallace 9 1 0 0 Not productive weak,	1948 Beaufort Burgaw 14 0 0 0 Not productive, weak, "Wallace 9 1 0 0 0 Not productive, weak, Orton Wallace 11 1 0 0 0 Not of cross 54-B6 Burgaw 14 1 0 0 Black rot, tough Topsail 25-84 0	Burgaw 14 0 0 0 Not productive, Wallace 9 1 0 0 0 Not productive, Wallace 11 1 0 0 0 Not of cross Burgaw 14 1 0 0 0 Black rot, tough G-52 1 0 0 0 Melting pulp, ac Self 4 4 2 0 Melting pulp, ac	1948 Burgaw

Tipon, Testatant, very aweed

Remarks

T96T

456T

756T

Parentage

Plants

Selections

	Small, cluster	Sweet, cluster, large	Large, smooth, sweet, attractive	Productive, cluster, late, oval, sweet, good	Med. large, smooth, attractive, good flavor	Sweet, good flavor, attractive	Small	Very poor	Oval, small, cercospora	Large, poor follage		/ All small, black, fair cluster	Sweet, fair, medium vigor		#69 largest fruited								Note: Heavy losses in nursery rows, especially of selfed	seedlings.		
	0	H	H	Н	Н	Н	0	0	0	Н	0	0	0	0	0	0	0						-			
	H	Н	H	N	2	N	0	0	۲	-	٦	H	0	٢	Н	0	0									
	15	22	17	16	10	25	7	N	15	5	Н	3	9	9	0	3	Н									
	507	177	126	145	104	157	116	32	151	108	100	58	100	96	7/	37	707	0	7	69	7	07	85	20	80	
	20-193	11-173	=	=	=		=	20-193	=	=	11-11	11-113	11-117	11-153	11-173	11-178	17-117	Self			000	==	==	=	=	
1951	Scupp	=	Howard	Yuga	Lucida	25-8-26	Topsail	Memory	Hunt	25-6-5	Dulcet	=	=		=	=	=	5-45	2-88	9-1	8-6	9-100	9-219	11-104	11-117	
	55	99	57	58	59	99	19	62	63	79	65	99	67	89	69	70	77					.1				

.....

Selections

T 96T	
496T	
756T	
etne L ^q	282188 88288 8828 88187 881 882 882 882 882 882 882 882 883 883 883
9	Harrer er
Parentage	11-153 11-173 11-173 11-173 17-197 17-197 17-125 20-122 20-122 20-123 20-123 20-123 20-123 20-123 20-123 20-123 20-123 20-123



Table 2 (continued)

				Sele	Selections	US		
	Parentage	9 8 8	Plants	496T	896T	096T	T 96T	Remarks
	1952							
	Duplin	Self	197	38	7	7	N	Soft pulp, acid, cluster, vigor, persistent
72	Latham	Duplin	148	00	N	m	N	Med. soft pulp, acid, fair, small, vigor, persistent
73	Topsail		119	17	9	2	N	Med. soft, sub-acid, cluster, vigor, persistent
77	Hunt	=	125	0	m	2	N	fair, persistent
75	Hunt	11-178	56	7	0	0	0	
94	86-9	9-308	N	0	0	0	0	
	1953							
77	Latham	20-119	198	77	100	7	9	Fine foliage, good flavor, cluster, persistent, even
78	Howard	5-63	10	~	0	0		Med. large, poor, black rot
79	Dulcet	20-119	68	2	-	-		
80	Thomas	17-197	205	27	00	2	7	skin,
8	Stuckey	11-178	82	00	7	2	N	rot, cluster, persistent
82		86-9	18	2	~	0	0	Acid
83	=	Dearing	57	2	-	-	Н	Black rot, small, sweet
78	=	33-23	95	7	m	m	3	Black rot, small tough, sweet, sugar
85	Nevermiss	17-197	203	27	00	2	7	, small, sweet
98	=	17-123	188	77	2	3	N	Small, cluster, productive, persist.
87	Topsail	20-40	172	6	7	2	m	High sugar, good, cluster, persist., even prod.
88	=	28-193	119	11	2	7	7	ood foliage
68	5-63	9-308	52	6	7	7	3	
96	9-308	5-63	3	- 1				
16	11-60	33-61	33	9	0	0	0	Early, black rot, high sugar
92	11-178	33-23	18	2	2	-	-	High sugar, small
93	15-165	20-119	39	٦	~	-	-	V. sweet, v. small, tight cluster
76	19-125	5-106	10	N	-	-	-	Productive, tight cluster

TO White eventuate . The court of the little 1711,1

	Remarks		4 4 5 5 1 4 5 1 5 1 5 1 5 1 5 1 5 1 5 1	acid, poor ilavor, cluster, plack for	small, acid, diack rot				urge, attractive, poor flavor, acid, smooth	fair	acid	urge, acid, fair	small, sweet	Fair, insipid, few with cluster	, small, black rot		Sweet, most small, good	Black, even, attractive, good	Cluster, sweet, good	Very cluster, acid, late, prod.	Large, sweet, shell, black rot, even	Black rot, small	Black rot, unproductive	sweet, shell, vigor, good	late, shell, sweet,			Small		
				SOI L'S	SOIT, S				Very large,	Large,	Large,	Med. large,	Fair,	Fair, i	Cluster		Sweet,	Black,	Cluster	Very cl	Large,	Black r	Black r	Early,	Small,		Poor fc	Very sn		
1	T 96T		C	V					7	3	0	-	٢	0	-		3	7	N	N	-			3	7					
suo	096T		C	V					2	3	0	-	Н	0	-1		7	7	N	3	N	0	0	∞	9					
Selections	8561		7	0 0	>				9	3	0	CV	Н	Н	~		20	-	3	7	3	0	0	12	2					3 6
Sel	496T		2	7-	-				10	9	0	9	Н	9	2		12	16	5	12	13	H	H	52	22	0	0			76-67-11
	stas [4]		100	176	52	0	0	0	77	43	10	24	77	93	34	3	189	203	141	130	116	129	172	200	200	31	96	7	0	0
	tage		1001	T=7=017	46-5-1	20-119	9-308	17-123	28-222	27-229	29-156	27-229	29-67	5-115	29-156	27-229	44-47	44-232	37-10-1	27-229	28-222	27-229	28-222	17-123	29-156	Self		***		Tetraploid orogan
	Parentage	1957.	4774	•ddpbc		48-2-7	=	=	46-15	46-7	99-97	88-777	43-123	53-121	72-40	=	Topsail	-		Latham		Scupp.	-	25-8-26		G-52	37-10-1	37-11-1	25-8-4	ににしてに併
			70	22	200	26	86	66	100	101	102	103	104	105	901	107	108	109	110	111	112	113	777	115	116					

TEACHERSTAND DOOR TIEROR TOGO! BUNCHEN there are clear the

1 1 1 1 1 1 1

1

	Remarks			Poor	Med. large, smooth /		> Bad location	Poor		Poor		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Vigorous, good follage, cluster, med. small, smooth Discarded		Large, white, sweet, very good	Sweet	Good foliage	_		Black rot	Black rot
	T96T			0		0	0									02			promite the second		
10	096T																				
cions	896T		9																		
Selections	496T		and Tohlo The	0	7		H	-				e21.	2		22	0	3	28	16	15	2
S		.e16.	E-	2 ~	1	_			- 4	0		see Table21.	× -4		~		~				
1	Plants	Table	0	1	7			41	7	15		See	202		122	07	18	107	8	10	77
		8	Totranloid orosepa	-32	09-09			86-	c	29-32	•	ecles crosses	Furgaw		09-	86-	-21	09-	-14	09-	44-15
	80 80 90	ecles	4	52	9	29	27	56		59	(S E	I a Bu		9	56	16	9	89	69	44
	Parentage	For 1954 species crosses	1955	15F	50-55	29-90	75-40	72-40	72-40	68-85	1956	#142-147	Willard	1957	Topsail		80	Hunt	Ξ	84	
				135	136	137	138	139	140	177		0	149		150		152	153	154	155	156

60-60 107 28 68-14 89 16 69-60 109 15 44-15 14 2 7 Tetraploid crosses see Table16.

#157-167

Signature the period of the party of the par * 1-11-11 13 414115

, I fdef ose sessore asfosdi Species unasses see Reble . Tetrapi id crosses se "able to Species arosees see T A -1 was _ --

Table 3

Summary of average ratings of progenies in muscadine grape crosses for vigor, resistance to black rot, size and sugar.

A. Vigor of all seedlings, rated 1-10

0 3			Poll	en parent	s and the	ir ratin	ıg	
Seed parent its rating	and	Tarheel 8.0	Burgaw 6.0	Wallace 4.0	Willard 3.0	Pender 4.0	Duplin 5.0	G-52 5.0
Self		5.6	4.4	3.8	3.5	3.9		
Scuppernong Topsail Thomas Latham Cape Fear Mish	6.0 9.0 6.0 5.0 4.0 6.0	5.8 7.1 5.7 6.5 6.2	5.3 6.4 4.8 6.5 5.4 4.6	4.7 6.4 5.4 4.5 4.7	4.6	5.0	4.9	5.2

B. Resistance to black rot of all seedlings, rated 1-10

C			Poll	en parent	s and the	ir ratin	ıg	
Seed parent its rating	and	Tarheel 8.0	Burgaw 8.0	Wallace 6.0	Willard 5.0	Pender 7.0	Duplin 6.0	G-52 5.0
Self		7.8	7.4	5.3	5.1	5.1		
Scuppernong Topsail Thomas Latham Cape Fear Mish	6.0 9.0 8.0 7.0 8.0 5.0	6.2 7.8 8.1 7.9 7.2	4.6 6.7 7.7 7.6 7.1 6.0	3.3 5.2 7.2 6.9 6.0	3.1	5.1	4.04	4.7

Summany of average ratings of arosenies is amsoudine crope crosses for where, resistance to black rat, size and

- bets . agaiffores Ils to sorty .

Doplin G-52							Seed purent a
4		•	*		15		
	•	64	٥	* *	9		
		*	n	•	•	a	erpoernone opsail horss athar

. Losistance to black not of all seedlings, rated 1-10

	ungilatinak a midd						
its rating	Tarbeel.	Furgas	esallace.	Villard.	Pender	Duplin .	02m0
1103			0.2	(* 3	*		
Seupmernong Eopsaf 1 Sathar Jape Tear	7 : e :	•	2.2 2.2 2.0 6.0	Γ,	٠	•	1 0

Table 3 (continued)

C. Berry size of perfect-flowered seedlings - Av. wt. in grams

Seed parent	and		Poll	en parent	s and the	ir size		
its size	anu	Tarheel 3.10	Burgaw 4.10	Wallace 4.20	Willard 3.50	Pender 3.50	Duplin 4.50	G-52 4.40
Self		1.82	3.21	2.70	2.71	2.90		
Scuppernong Topsail Thomas Latham Cape Fear Mish	5.5 6.0 4.3 4.6 5.0 4.8	3.31 3.72 3.27 3.41 3.41	3.37 3.68 3.23 3.51 3.77 3.08	2.97 3.74 3.53 3.06 3.57	3.32	3.55	4.30	3.60

D. Sugar of perfect-flowered seedlings - Percent total soluble solids

~ 3	7		Pollen	parents a	nd their	sugar re	ading	
Seed parent its sugar re		Tarheel 16.4	Burgaw 16.2	Wallace 14.7	Willard 15.5		Duplin 14.0	G-52 10.3
Self		16.6	17.9	14.8	17.3	16.9		
Scuppernong Topsail Thomas Latham Cape Fear Mish	17.5 22.7 18.4 17.6 17.8 15.6	16.2 17.9 17.0 18.7 14.8	15.5 18.7 17.7 18.6 15.4 17.5	14.9 15.9 15.4 16.7 15.4	15.7	15.5	15.1	14.6

		ir size						
				Wallace .20		Tarheel 3.10		agis of:
			Í .	07.3	15.0			
*	٧	. n	Se*e		17,6	,	5. 6.	

		er isyua	riedt ba				
- A				rellace			es de la company
			*	*			
***	15,3	* 20	1	15,		* * * * * * * * * * * * * * * * * * * *	

Table 4.

Summary of average ratings of progenies in muscadine grape crosses

			Char	acter and	pollen	parent		
Seed parent	Vi	gor Wallace		tance Wallace		size Wallace	Sug Burgaw	ar Wallace
Smith Creswell Hunt Lucida V21R15B2	4.7 4.7 4.7 5.1 4.8	3.9 4.2 3.3 4.2 4.5	6.0 5.4 5.4 5.0 6.2	5.0 4.7 4.5 4.3 5.0	3.59 3.97 3.38 4.45 3.12	33.3 35.1 36.2 45.9 30.2	18.3 17.5 19.2 16.1 20.4	16.4 16.4 16.0 15.6 18.3

Table 5.

Summary of average ratings of progenies in muscadine grape crosses

Seed			Cha	aracter and	d poller	n parent		
parent	Vig			istance		ry size	Sug	
	G-52	37-10-1	G-52	37-10-1	G-52	37-10-1	G-52	37-10-1
Scupp.	6.4	5.4	6.1	6.2	3.60	31.0	19.0	19.6
Thomas	6.7	6.8	7.0	6.7	3.04	32.8	19.2	18.3
25-8-26	6.5	6.8	6.4	6.7	3.75	34.5	17.8	

ratings of propositi

		93.73			7			
	Magaus		stagment !					
	5.		٠	*		100		
9	4 10 2		•	•	2			
Α	n	· o	*		٥	*	۵	
*		20	Ar .	•	۰	•	,	
	٥	0		4	2			

rable .

Symmetry of average ratings of provenies in muscadine grape crosses

					tee			
	****	Francis Francis	~	<u></u>	6-5?			
		to a difficulty of a page 1. The 1.		with contributable that they are		* *************************************	and the same analysis of the same	
3,91				2		•		
C. I	3.21		3.4	•	Δ			
		7		100		7		-

Table 6

Difference in berry size in relation to their sex and seed parent in progenies of grape crosses. Berry size as weight in grams of 10 berries.

Pollen parent	Sex of seedling	Berry s	ize with 25-8-26		t seed p		Range
11-173 11-173 Increase Increase	grams	28.9 39.7 10.8 37.4	35.7 47.0 11.3 31.6	40.1 43.2 3.1 7.7	42.8 52.2 9.4 22.0	54.7 55.7 1.0 1.8	25.0 16.0

Table 7

Differences in average berry size in grams in relation to sex and to pollen parent in progenies of grape crosses. Berry size as weight in grams of 10 berries.

Seed	Sex of	Berry siz	e with diff	erent po	llen paren	nts Range
parent	seedling -	37-10-1	37-11-1	G-52	11-173	Parentage
Scupp. "Increase	grams	28.5 34.3 5.8 20.4	31.9 36.9 5.0 15.7	31.6 39.9 8.3 26.2	42.8 52.2 9.4 22.0	14.3
25-8-26 " Increase	grams	32.3 36.6 4.3 13.2		33.2 40.0 6.8 20.5	35.7 47.0 11.3 31.6	3.4 10.7
Thomas Increase	grams	30.8 34.7 3.9 12.7		27.9 32.8 4.9 17.5		-2.9 -1.9

Concrete and serry size in relation to their sex and seed parame in proger of of the crosses.

10 berrin.

11 berrease and ...

12 berrease and ...

13 berrease and ...

14 berrin.

Table 7

			Collection		*	
1		*		:		
7	? * *					Con-
u.E.				•		

General characteristics of progenies of different parents Best parents starred

Beaufort. ? Used for productivity, results negative, weak, poor foliage poor flavor, acid.
Burgaw. & Good vigor, small cluster, dry scar, dull.
Cape Fear. & Oval shape, late, poor malic acid flavor, insipid.

*Creek. \$ Only N. C. seedlings are 4x Creek x open. Vigorous, good acid flavor.

*Creswell. \$ Good flavor, sub-acid, fair cluster, dry scar.

Dearing. & Small, sweet, tough, good flavor.

Dulcet. ¿ Cluster, small size, fair flavor, average vine.
Duplin. Soft melting pulp, very acid, cluster, fair berry size, oval, vigorous

Howard. ? Sweet, large size, attractive smooth skin, susceptible to black

Hunt. 2 Oval, smooth skin, susceptible to black rot.

*Latham. ? High sugar, good flavor, tough skin and pulp, vigorous

*Lucida. & Large size, attractive smooth skin, low sugar, vigorous.

Memory. 2 Used for early ripening, large size and determinate growth, results negative, seedlings poor, susceptible to black rot.

Mish. 4 Used for its reputation for wine, seedlings poor, susceptible to black rot, n.g.

Nevermiss. 2 Used in place of Scuppernong in progeny tests - fair.

Pender. & Oval, yellow, cross had few seedlings.

Scuppernong. ? Between 1910-1925 seedlings of this and of Thomas were better than other varieties used as parents. It was used as a parent in progeny tests. Scuppernong, at Willard, produced mediocre flavored seedlings. susceptible to black rot, shattering clusters. Scuppernong from Scott's Nursery produced better seedlings, but not as good as other parents.

Smith. # Used for productivity, results negative, poor flavor, shell,

low vigor.

Stuckey. ? Large size, sweet, susceptible to black rot. *Tarheel. ? Cluster, persistence, vigor, resistance to black rot, susceptible to downy mildew, sweet, mild, insipid, thinner skin, soft pulp, small size, continuous flowering.

*Thomas. # Vigorous, productive, fairly resistant to black rot, sweet,

good flavor, dull skin, small size.

*Topsail. ? Vigorous, resistant to black rot, not productive, very high

sugar, mild good flavor, smooth skin.
Wallace. F Vigorous, susceptible to black rot, poor foliage, acid, low sugar, dull skin, loose cluster.

Willard. & Susceptible to black rot, poor foliage, low sugar.

Yuga. & Good flavor, thin skin, oval, late, pink color, late ripening.

*V21 R15 B2. \$ (seedling of Latham) high sugar, fine flavor, small size, tough skin, dry scar, early.

G-52. f (from "Hope") large size, cluster, thick skin, acid.

*25-8-26. 4 (from "Hope") (also grown as 8-26, but not of current series) productive, acid, "Scuppernong" flavor, susceptible to black rot, vigorous.

Besufort. ? Used for productivity, results negative, week, por foliage noor Flavor, ...

Burraw. ? Good wirer, suell civiter, dry arar, war...

Cape Febr. & Ovel thap: 'ate, mount maile acid flavor, '. . Creeks & Only . . seadifing are in Creek at or n. Vigorous, roud acid

. hoon danot there . Llend .

Sweet, large size, attractive smooth win, susceptible to black \$.brg.off

.i weeld of blothwooms . . . divome .levO & .

Large size, attractive amonth sking, low range, vironous. sed for early ripacing, large dire and determinate growth, to negative, seedlings puor, susceptible to black

Cender. & Oval. . Gross had few . .

norg. f en 1910-1975 seedlings of this rod of Thomas were then other vary the used as perents. It was much as a parent weath. For nong, at Villare, produced medioere flavored

any in artite men produced better seedlings, but not as good as other parents.

. fod for productivity, results negative, poor Clavor, shell,

ter. i lenge size, suecu, susceptible to black rot, ruccookible to dow wilder, sweet, mild, insigid, thinner win, soft . Top. small store cont more Movering.

Thomas, s "iversees, productive, fairly . stant to black ret, seest, go lave, dall situ, seell it.e.

Topse I. f Vigorous. restablet to black of, not productive, very high user, and productive, another and the

.as, susneptible to rot, poor folisge, acid, low

elli, some chamber.

optitile to black rot, soor foliams, low suger.

ead: " of lather time fire flavor, sould story

a skil.

. (From . . . rge ise, claster, thick skin, acio. - . . (The Hop) (also grown as C-1) but not of number series)

- 37-10-1. f (from "Hope") productive, vigorous, cluster, acid, medium size.
- *11-173. (Topsail x Tarheel), vigorous, resistant, cluster, only one of series #11 to transmit any berry size.
- 11-178. (Topsail x Tarheel), medium vigor, productive, insipid.
- 5-63. \$\(\xi\) (Scupp. x Tarheel) vigorous, cluster, mild, insipid fair. 5-106. \$\xi\) (Scupp. x Tarheel) vigorous, cluster, productive, acid, low
- 5-115. ? (Scupp. x Tarheel) vigorous, cluster, productive, acid, low sugar.
- 17-123. 2 (Latham x Tarheel) cluster, vigorous, productive, resistant,
- some with Tarheel flavor, sweet.
 *17-197. * (Latham x Tarheel) cluster, vigorous, productive, resistant, some with Tarheel flavor, sweet.
- *20-40. ? (Thomas x Tarheel) very cluster type, vigorous, productive, resistant, small, sweet, good flavor (20-30 should be as good a parent.)
- *20-119. \$ (Thomas x Tarheel) very cluster type, vigorous, productive, resistant, small, sweet, good flavor (20-30 should be as good a
- 20-193. F (Thomas x Tarheel) very cluster type, vigorous, productive, resistant, small, sweet, good flavor (20-30 should be as good parent.)
- 27-229. (Lucida x Burgaw) large size, acid, low flavor, cluster, vigorous, productive.
- *28-193. ? (Lucida x Wallace) large size, smooth skin, attractive, acid. low flavor, cluster, vigorous, productive.
- *28-222. [(Lucida x Wallace) large size, smooth skin, attractive, acid, low flavor, cluster, vigorous, productive.
- 29-67. £ (Creswell x Burgaw) vigorous, productive, cluster, good flavor. 29-156. £ (Creswell x Burgaw) vigorous, productive, cluster, good flavor. 33-23. £ (V21 R15 B2 x Burgaw) high sugar, good flavor, small. 44-47. £ (Scupp. x G-52) productive, vigorous, attractive, smooth skin,

- good flavor, good size.
 44-232. (Scupp. x G-52) productive, vigorous, attractive, smooth skin,
- good flavor, good size.
- 46-7. \$ (25-8-26 x G-52) large size, smooth skin, acid, low sugar, vigorous.
- *46-15. (25-8-26 x G-52) large size, smooth skin, acid, low sugar, vigorous.
- 59-32. (Lucida x 11-173) should transmit size, cluster, smooth skin, attractive.
- *60-60. \$\footnote{8}\$ (8-26 x 11-173) size, smooth skin, attractive, cluster, good flavor, sweet.
- Duplin Sq_(several) soft pulp, very acid, oval, cluster, vigorous. Back-cross with these should give soft pulp with better flavor and less acid.
- 64-53. f (from Beula) not used. Saved for use as parentage for size, fair flavor.

. उ नावतं पुन्त हे जावतास्तरो व . sac al) vigorous, almoter, mild, insipid . x Taradel) vigorous, cluster, productive, acid, low seg . 17-183. f Tarbeel) riust vigorous, productive resisbanb. come toh Parboll flavor, sweet. *17-197. # (Latham x Tacheel) : mater, viporons, productive, resistant, some with I wor, estionbong esconager . . . redeals year (Learing) & sico large sish, smouth skin, attractive, naid, ens, predentive, burge size, amouth skin, attractive, acto, American disprove, brecharites, ' lureson vigorous, productiv, cluster, good flavor. . I growsfit boog , dg i (v . aktractive, smooth skin,

.

should bronsmit size, cluster, smooth skin,

erid, eval, elwstan, vis cus.

use . inved . so montage for sise,

o zih.

Table 9

Sources of various characteristics

Vigor: Tarheel, Topsail, Latham, Thomas, 17-123, 20-40, 20-119. Resistance to black rot: Tarheel, Thomas, progenies of Tarheel. Productivity: Tarheel, 20-119, 37-10-1.
Cluster: Tarheel, G-52, and their progenies.
Persistence: Tarheel, and Series #11, 17, 20.
High sugar: Latham, V21-R15-B2, Topsail and their progenies.
Large size: Lucida, Topsail, 11-173, 28-193, 28-222, 27-229.
Smooth skin: Tarheel, Lucida, Topsail.
Thin Skin: (relative) Tarheel.
High acid: Duplin, Creek.
Good flavor: Thomas, Latham, Creswell, 60-60, 20-40.
Oval shape: Duplin, Cape Fear.
Continuous flowering: Tarheel and progeny.
Soft & melting pulp: Duplin, Duplin S1.

Susceptible to mildew = Tarheel.
Susceptible to black rot: Wallace, Willard.
Poor flavors: Tarheel, Cape Fear, Lucida (?).
Tough skin: Latham, Thomas.
Tough pulp: Latham.

Other Notes

Color: Light color is recessive. Some varieties like Thomas are homozygous black. There are other color factors in and varieties giving pink, red, purple, tan, yellow.

Memory and Lucida at Willard have maintained good green foliage through the summer and harvest when all other varieties have been chlorotic and defoliated. At first this was believed to be due to tolerance to poor soil conditions and wet feet. Both varieties are susceptible to black rot. It may have been due to tolerance or immunity to Pierce's disease or other virus. Inheritance unknown.

Determinate growth, not as long trailing canes as most varieties, Memory. Inheritance unknown.

. Classon in a second of the contraction of the con

,

.

ens reconst carl as solde verification

Table 10

N. C. selections being tested by Southeastern Experiment Stations

Location and date sent

	Mississippi	sippi	Georgia	20	FJ	Florida	Alabama	S. Carolina	
Selection	Meridian	State	Experiment	Tifton	Jay	Live Oak	Auburn	Columbia	Owen's Nursery
5-63				55	55				
5-115	55	55-56	55	55		57	56	56	56
11-173	55			55	55				
11-178	53	53	53-55	55	55		56	56	56
11-186	55	55-56	55	53	55	57	56	56	56
15-161	55	55	55	55	55		56	56	56
17-123	53	53-55	53-55	55	55		56	56	56
17-197	53	53	53-55	55	55				
20-30	53	53	53						
20-119		55-56		55	55		56	56	56
24-42	53	53-55	53-55						
25-59	56	56	56				56	56	56
27-128	56	56	56			57	56	56	56
27-262	56	56	56			57	56	26	56
29-193	99	56	56			57		57	
33-13	56		56				56	56	56
29-47						57			
27-TT2						23			

Table 11

Yields of muscadine varieties and selections at Central Research Station, Clayton, N. C. Pounds of fruit per vine.

Selection	1958	1959	1960	Variety	1958	1959	1960
5-63	32	75	75	Burgaw	12	33	70
9-1	14	44	60	Dearing	12	30	84
9-305 Alberra		35	52	Dulcet	22	54	87
9-308	6	70	120	Duplin	19	42	90
11-173	19	38	97	Higgins	9	58	100
11-178	20	34	63	Howard	9	26	27
11-186	28	46	105	Hunt	13	62	131
15-161	12	25	41	Memory	-	2	7
15-165	9	21	62	Nevermiss	3	28	59
17-55	13	28	88	Onslow	13	31	39
17-197	16	51	78	Scupp. Scott		28	49
20-30	40	15	84	Scupp. Manteo		8	17
20-30(4x)	20	24	41	Tarheel			30
20-119	39	82	151	Topsail		38	56
25-59	2	39	64	Yuga	3	63	66
27-128	8	26	46	B6-19	13	51	44
27-229	4	50	40	37-10-1	11	50	81
27-262 Pandie	13	60	40	25-8-26	19	86	99
27-354	3	30	66	G-52		10	23
28-193	7	30	58	Ga 14-20		43	6
29-32	17	37	59	M 3	17	27	83
29-47	8	35	52	M 4	29	8	49
29-115	20	25	75	M 7	15	29	45
29-156	21	50	82	MIO			5
29-193 cham		32	67	M12	14	39	67
33-9	8	22	52	M15	12	34	62
33-13	8	25	39	M16	5	27	36
33-98	12	19	39	M17		3	4
33-106	2	17	43				
44-15	13	30	44				
44-47	14	70	49				
46-15		19	27				
56-98	23	50	43				
57-56		28	78 34	tora			
58-89F	23	65	100				
59-32	32	60	136 Ram				
60-60	27	10	132 m	Jan 1. de			
64-53		42	7				

II oldeT

domestat leates de controctes bus estás. (e)

		handang			24		
		Descring					
	5,4			07.0	9		
					61	`	
					00		
		511				No.	
				25. 21. 28. 28.			
		animovel		22			
	31	Nevermina Noclos				-	
		#300 ·					
		oedcal acqued					
	8	Objection - Land	42				
		feedusT	151		39		
	38	Liscol			4.0		
					8		
leh	53	86-19					
		37-10-1					
		The state of the s			3		
	63	da "L-20					
					17	*	
						*	
			7				
		0.03					
					L. de		
						-	
	34						
4	۶						
			63				
			6 4				
			,				
					(Tak		

Table 12.

Growth and productivity of colchiploid vines and comparison of berry size and pollen with diploid vines.

	Vigor rating	Productivity rating	Berry weight	y size in grams	Pollen	
	4x	4x	2n	4x	2n	ons 4x
igorous						
Thomas	9	5	3.9	6.8	29-31	33-39
Creek	9	4	3.6	4.7	27-31	33-39
M47-9B	9	4	-	4.5	28	33-35
M51-9B	8	4 3 7	3.9	5.6	-	36-39
NC 17-123	8	7	3.9	5.3	30	33
NC 11-178	7	7	4.2	5.5	28-30	33-37
NC 20-30	7	7	3.3	5.9	31-33	35-38
M6-4A	7	5	4.0	5.0	28-30	34-38
Higgins	7	5	9.1	12.7		
Normal						
Hunt	6	1	5.7	7.0		
Lucida	6	3	-	7.1		
Dallas	6	0	-			
Dearing	6	1 3 0 3 5	3.7	4.4		
M7	6	5	3.7	4.8	30	37-39
leak						
Topsail	5	2	5.4	6.3	27	33-38
Yuga	5	4	4.0	5.2	-	36-38
M1.4-5A	4	3	-	4.8	***	34-36
Owarf						
Scuppernong	D	4	5.2	6.3	29	35-37
Dulcet	D	4	4.0	5.3	29	35-38
NC 17-197	D	4	3.8	4.0	29	33-39
MO	D	4	3.8	4.8	31	35-38

Pollen size			tvi rounc	Vigos	
			reiting	at the s	
			22.50		1.2
(5-65 In-68	46	м			
The same of the sa	P	M			
35		- S	<i>A</i> .		77 PF
De ser & ser	ra .	4	· ·	8	
	a				11/2_21
125 - 01 mm	4	• 1	1	1,	
36- 51		٩	ž		
28-30	**************************************	o A			
	*	•			
	i. a	*			
		-			10.0
	-				
	77	-	2		1.
- 1		ж		9	
	w	я	3		
	*	74			
36-36	74 ,	- migar			tings
		*			
	*	*	77		
		,	<i>λ</i>		
_5. 62 -5. 62	4	n	4		
	•	^			

Table 13.

Distribution of propagations of 4x colchiploids

	U. S. Hort. Meridian Loomis	Georgia Experiment Fry	California Illinois Davis Olmo Barrett	Illinois	Alabama Davis	N. Carolina Greensboro Dunstan	Georgia Gay Owen
Dulcet	×						
Creek	×	×					×
Higgins	×	×					1
Phomas	×	×					×
Topsail	×	×					* ×
Scuppernong							
Yuga	×	×					þ
NC 11-178	×	×	×	×	×		÷ >
NC 17-197	×						4
NC 20-30	×	×	×	×	×	×	>
M7	×	×			×		*
OTW	×				×		4
M6-4A	×	×	×	×	l ×	*	×
M14-5A	×	×					4 >
M47-9B	×	×					< >
M51-9B	×	×					< >



Table 14.

Berry measurements of diploid and colchiploid vines of different selections 1954

Selection	Sample	Berry	size_	See	d
	size No.	Weight grams	Diam.	Per berry	Wt. 100 grams
2n Dulcet 4x Dulcet	20 73	3.8	18.5	3.8 2.3	4.25 5.57
2n Creek 4x Creek	10 95	1.8	16.6	3.3 2.4	5.03 6.39
2n M7	35	3.0	17.2	4.0	3.13
4x M7	117	3.5	17.9		4.51
2n M10	20	3.8	18.8	3.9	4.81
4x M10	102	5.2	20.8	2.4	6.28
2n NC 11-178	55	3.6	18.3	3.8	4.83
4x NC 11-178	368	4.0	19.2	2.4	6.34
2n NC 17-123	25	3.1	17.5	3.7	3.48
4x NC 17-123	49	4.4	19.1	3.0	5.60
2n NC 17-197	35	3.0	17.5	3·4	4.08
4x NC 17-197	53	4.1	19.0	2·4	6.01
2n NC 20-30 4x NC 20-30	35 14	2.6	16.2	4.0 3.4	3.74 5.74

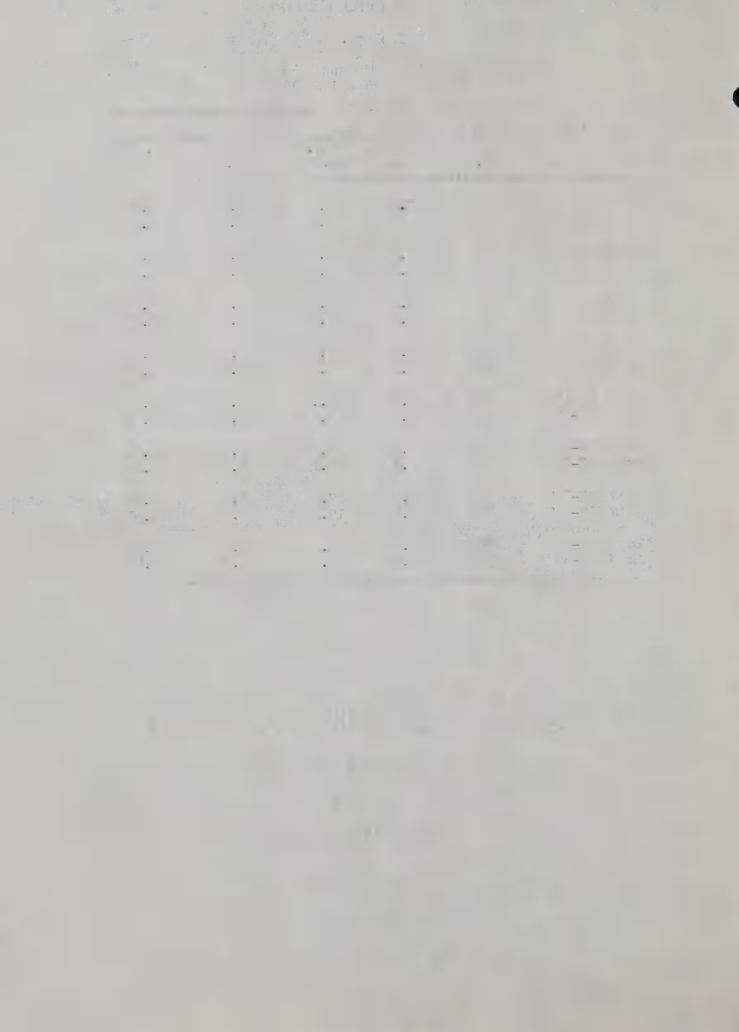


Table 15.

Germination, survival and growth of tetraploid and diploid seedlings (1954 seed)

	Ave. height 2nd year feet	2.3	1.5	5.5	3.4
	Ave. 2nd fe		Freed	41	
ear	54+	0.0	0.0	91.7	28.8
th 1st y	12-24	38.5 29.2 0.0	29.6 19.9	2.8 7.0 91.7	21.7 44.6 28.8
les growt	1-6 6-12 12-24 24+	38.5	29.6	200	21.07
Inch	1-6	32.3	20.4	0.3	5.0
	Survival 1st year	78.0	63.2	86.3	84.2
	Seedling Survival No. 1st year	206	817	328	165
	Germination %	63.3	67.7	82.0	36.0
	Type of cross	4x pistillate x open	4x perfect fl. x open	2n pistillate x 2n	2n perfect fl.x self

Table 16.

Crosses with tetraploid muscadine grapes (all parents are 4x unless otherwise marked.)

Year & cross	Parentage	Seed	Nursery	Planted		Selections 1960
1954	all tetraploid Thomas Topsail Dulcet Yuga Creek Scupp. All tetraploid NC 11-178 NC 20-30 NC 17-12 NC 17-19 M 51-9-1 M6-4A M 47 -9B M 14-5A	(Very (Vines			cuppernong &	
	M 10 M 7					
	All of above selection					
Followi	ng seed obtained in al	ove crosse	es			
117	(4x) Thomas x NC 20-		2	2		0
118	(2n(Scupp. x (4x) M		3 2	37 r	not of cross	3
	(2n) Scupp. x (4x) M			1)		
120	(2n) Scupp. x (4x) M		0	2		
121	(4x) NC 11-178 x sel:	3	2	T		0
Followi	ng seed from open poli	lination of	tetrap	loids saved	and grown	
	NC 11-178 x open	532	421	275	72	1
	M6-4A x open	93	34	19	9	0
	M10 x open	48	22	13	0	0
	NC 17-197 x open	136		56	2	0
	NC 17-123 x open	151	102	50	23	1
	NC 20-30 x open	53	42	24	17	2
	M47-9b x open	16		5 7	1	0
	M14-5A x open M7 x open	43 158	26	17	0 5	0
	M7 x open Thomas x open	52	63	3	2	0
		150	111	89	79	9
	Creek x open Dulcet x open	75	65	50	18	1
	Yuga x open	53	20	17	9	0
1955	Most of bags and fr	it lost in	3 hurr	icanes		
122	Thomas x NC 11-17		6	6	0	
123	Thomas x M10	14	1	1	1	
124	Thomas x M6-4A	2	1	1	ī	
125	Yuga x NC 11-17		6	4	1	
126	Creek x NC 11-17		11	9	6	
127	Creek x M10	9	2	2	2	

onse with to abloid inschine crapes to are no narked.)

where the statement of						
0361 pez.						
A state of the second second second second	agraph of agent amounted t	processors in a set of the contract of the contract of				
					77.	
(ItsageT & peen		no swansmy				
					4	
w moold nt				VINB	and .	
						٩
				-		
		1				
					Quantity	
						-
7						
						-
		na				proc.
1.0						
						_
		1				
		85 50 27				
		2.2				
		230367	TOUT F			
		loanes 5	2			
	1	Š				

Year & cross	Parentage	Seed	Nursery	Planted	Survived	Selections 1960
1955 (c	ont'd)					Aller and the control of the control
128	Creek x M6-4A	13	5	5	3	
129	Scupp. x NC 11-178	23	3	3	3	
130	Scupp. x MlO	5	4	3	2	
131	Creek x NC 20-30	84	19	17	13	2
132	Topsail x NC 17-197	2	1	1	1	
133	Thomas(4x) x NC 11-178(3	2	1	
134	Thomas(2n) x NC 11-178(4x) 69	14	9	8	1
	NC 11-178 x self	372	69	51	21	
	M10 x self	27	15	8	0	
	M6-4A x self	132	46	42	28	2
	M7 x self	76	27	23	0	
	M51-9b x self	10	8	7	0	
	M14-5A x self NC 17-197 x self	7	4	2 18	0	
	NC 20-30 x self	198 270	22 29	25	0	
	M47-9b x self	40	8	5	0	
1957						
157	Dulcet x M47-9b	9	1	0	0	
158	Thomas x M6-4A	14	0	Ö	0	
159	Thomas x M47-9b	24	7	5	3	
160	Thomas x NC 20-30	25	13	12	11	
161	Topsail x M6-4A	0	0	0	0	
162	Topsial x M47-9b	4	1	1	1	
163	Yuga x M6-4A	7	0	0	0	
164	Yuga x M47-9b	0	0	0	0	
165	Yuga x Dearing	1	0	0	0	
166	Scupp. x NC 11-178	13	10	9	7	
167	Higgins x NC 11-178	24	0	0	0	
1958						
190	Yuga x Dearing	11	7	6	6	
	Higgins x M6-4A	0				
	Higgins x NC 11-178	0				
	Lucida x M6-4A	0				
	Lucida x NC 11-178	0				
	Dallas x M51-9b Dallas x NC 20-30	0				
	Dalias X No 20-30	O				
1959	(4x) x (4x)					
234	Higgins x NC 20-30	19	5			
235	Higgins x M51-9b	11	0			
236	Lucida x NC 20-30	5	0			
237	Lucida x M6-4A	4	2			
238	Yuga x NC 20-30	27	17			
239 240	Yuga x M6-4A Yuga x M51-9b	14	12 8			
241	Yuga x M47-9b	5	6			

					(b) dries	15 6
			23		Steel at O	
					2	
	73				LIBRUUL	
		{				
		3		200 x (ns		133
	8	3.5			64-68	
	\$42				F98	
	23	27	76	2188 X	Aug.	
	7		0.5			
			23/25			
			198)E -	
			9			
		0				
		7		~		
				eyen y element		
			2.3			
0	0					

Year & cross	Parentage	Seed	Nursery		abled ?		
1959 (6	ont (d)						
	ail x NC 20-30	6	7				
	ail x M51-9b	8	6				
	ail x M47-9b	3	3				
	k x NC 20-30	73	51				
	k x M47-9b	11	0				
	as x NC 6-4A	4	4				
* .	as x M51-9b	4	4				
	nas x M47-9b	10	9				
	(2n) for triploid						
	ins x 20-30	3	0				
	ins x 87-100	9	2		2		
	da x 87-100	34	12	2	1		
253 Luci	da (2n) x 109-34	27	7	2 2	3	(all 2n)	
254 Yuga	x 20-30	183	9	3	2		
255 Yuga	x 87-100	111	6	1	1		
256 Yuga	x 109-34	29	4		1		
257 Tops	ail x 20-30	23	0				
258 Tops	ail x 87-100	10	0				
259 Tops	ail x 109-34	1	0				
260 Cree	k x 20-30	0					
261 Cree	k x 87-100	58	3		1		
262 Cree	k x 109-34	49	9	1			
263 Thom	nas x 20-30	14	0				
264 Thom	nas x 87-100	12	0				
265 Thom	nas x 109-34	62	0				

		7 6 6 7 4 9 9 9		245 242 244 245 245 246 247 248 248
21001	CA CA 60	12 2 7 7 4 6 9 7 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6	34 27 27 111 29 29	250 FX
f			10 14 45 68 114 45 62 114 62	

Table 17.

Hybridization of Vitis Rotundifolia With Other Species (see note at bottom of Table 18)

	V. ro		lia pollen	Reciprocal cross			
Evitis Species	Bags	Seeds	Seedlings	Bags	Seeds	Seedlings	
Labrusca	67	328	16	38	0	0	
(species and Concord)	91	720	10	76	O	0	
Vinifera	52	516	65	52	14	4	
(Malaga, Verdell, Black H	amburg,	seedlin 49	ngs of Malag	(a) 22	3	2	
Bicolor	23	110	3	23	0	0	
Cordifolia	33	233	9	54	0	0	
Bourquiniana	45	341	95	51	4	1	
(Herbemont) Lincecumii	0	0	0	19	0	0	
Aestivalis	63	271	61	44	1	0	
(species and Norton) Arizonica	0	0	0	11	0	0	
Californica	0	0	0	8	0	0	
Baileyana	5	0	0	0	0	0	
Vulpine	0	0	0	9	0	0	
Candicans	0	0	0	6	0	0	
Champini	10	0	0	0	0	0	
Longii	10	0	0	0	0	0	
Labrusca x Vinifera							
Niagara	0	0	0	6	0	0	
Lindley Wilder	13	0	0	0	0	0	
Salem	2 2 3 2	0	0	5	0	0	
Agawam	3	29	5	5	0	0	
Marguerite	2	9	0	1	0	0	
Labrusca x Aestivalis	d	70	C)	0	0	0	
Gold Coin	8	17	8	0	0	U	
Lincecumii x Ruprestris America	5	0	0	0	0	0	
Lincecumii x Labrusca Beacon	8	187	2	2	0	0	
Lincecumii x Bourquiniana Muench	2	21	4	0	0	0	
Labrusca-Aestivalis-Vinifera	18	412	80	15	0	0	
Total	389	2523	353	369	22	7	

				. JO manie		
			1000 100			
			***	-£	*_	
Jeedlines						111
0						
	14.					
e e						
0			ž.	110		
					32	-11/1
				341		
0						* *
		r.r				
						1 4 4 1 7 4 7
				0)		10071111
						-
				0		11s
						Service Address
				0		4

Table 18.

Hybridization of Vitis Rotundifolia

F2	Ger	ner	ati	on
----	-----	-----	-----	----

	V. rotundifolia pollen			Reciprocal cross			
Cross	Bags	Seeds	Seedlings	Bags	Seeds	Seedlings	
Vinifera - Rotundifolia	hybri	ds				en e	
Hybrid selfed	32	2	0				
Hybrid x Hybrid	8	0	0				
Hybrid open pollinated	-	61	5				
Hybrid x Rotundifolia	17	0	0	45	10	6	
Hybrid x Vinifera	8	0	0	12	42	2	
Bourquiniana - Rotundife	olia h	ybrids					
Hybrid selfed	15	0	0				
Hybrid x Hybrid	10	0	0				
Hybrid x Bourquiniana	6	0	0	0	0	0	
Hybrid x Rotundifolia	10	0	0	17	0	0	
Winchell - Rotundifolia	hybri	ds					
Hybrid selfed	25	0	0				
Hybrid x Hybrid	5	1	1				
Hybrid open pollinated	-	24	0				
Hybrid x Rotundifolia	17	4	2	12	0	0	
Hybrid x Winchell	6	0	0	0	0	0	
Total	159	92	8	86	52	0	

The data in Tables 17 and 18 are taken from a report of Muscadine Grape Breeding and Hybridization at the North Carolina Experiment Station by C. F. Williams. This paper was presented at the Annual Meeting of the Horticultural Section of the Southern Agricultural Worker's at Atlanta, Georgia in 1926 but was not published.

						4 P 11 2 P 1 3 4 4 5 5
						silotibandod - pasti i
			0			bindyf x bindyf
			Ž,		majo.	Mytric open poll nated
9	CI			C	s. L	Hybrid x notundifolis
S	547	SE				0 - (**
					a.I	lyorid selfed
			0			1-9 1119
						19.41b
						- 17 17 17 17
						,

•

Table 19.

Summary of Diploid Crosses with NC 6-15 and NC 6-16

Year & Cross	Parentage	Seed	Nursery	Field	Selection
1954					
	2n NC 6-15 x open	52	24	12	7 (numbered 615-1, 2, 3, etc)
1959	/ 7 = 7		0.4		
266	615-1 x open	43	24		
267 268	615-5 x open 615-8 x open	225 52	38 26		
269	615-10 x open	32			
270	615-11 x open	167			
310 311	615-1 x 77-51 615-5 x 77-51 615-8 x 77-51 615-5 x 615-11 615-11 x self	63 32 33 34 31	with Golden muscadine 7	Musca 77-51,	on was pollinated t, Van Buren, sib 615-11 and e set seed)
1954 to	1959 - no flowers on 2n	NC 6-1	5		
1960	2n NC 6-15 x open 2n NC 6-15 x Golden Mus 2n NC 6-15 x Van Buren 2n NC 6-15 x Muscadine 2n NC 6-15 x self	0 cat 0 0			

First M year gray Du 14 per some iden you a constitution

relabeled bleid greams)600	adround.	1,000
24 12 7 (number of	50		-573
24 12 7 (numbered 75-1, 2, 3, etc)	AC.	140 1 65-0 011 F3	
Cara & & Carac			646
2/	42	oil a viva	206
	325	12010 8 12mc.0	705
26	30	OLEMB & Spiers	368
36	37	Olfmill & Open	?ès
			ers
			0361
Couch of selection has pot that i	îà.	515-1 T / - 7	335
with bolden Muscet, la Buren,		1 - 1 > Com 1	2110
muscadime 'S-F', sio (15-11 and	33	615-8 5 77-52	
self, - only these set seed)		older & Auglo	
(2002-001-001-001-001-001-001-001-001-001	32	Ties x I 1-450	323
	7 000 0	19:9 - no : Nowers on fin	03 1661
	,	ar M self x open	
		2n M C-15 x Colden Mose	
	3	2n 1 Colf x Jag Buren	

Table 20.

Summary of Tetraploid Crosses With NC 6-15 and NC 6-16

Year & Cross			Paren	tage		Seed	Nurse	ry Field	
1957 177	4×	NC	6-15 x	open			11	10	
1958 191 192			6-15 x	open 4x NC 6	-16	1 7 5	139 10	129 Seed	from Dermen
1959			6-16 x 6-15 x	self 4x M6-4	A	0			
300 301 302 303 304 305 306 307	4x 4x 4x 4x 4x 4x	NC NC NC NC NC NC	6-15 x 6-16 x 6-16 x 6-16 x	self 4x NC 6 4x Cham 4x US 5 open	panel 20-2	31 0 21 6 2 45 16 3 314	Without selfs.	emas c ulation a	and possible

flett ydes				reer Cross
	r.		Los N. o-35 open	
using man, pass (2, 1)	01 799	08	4x MC 6-15 x 4x MC 6-16 4x MC 6-16 self 4x MC 6-15 4x M6-4A	2567 261 761
			425 MC 6-15 x open 6x MC 6-15 x solf 6-15 x 4x MC - 6x MC -	303
emasonlation and possible	inoditi		- 06	

.

Tetraploid Species Crosses

Year & Cross	Parentage	Seed	Plants
1954	4x Thomas x 4x Loretto 4x Thomas x 4x Dakota 4x Thomas x 4x US 519-6 4x Topsail x 4x US 519-6 4x Yuga x 4x Loretto 4x Yuga x 4x Champanel 4x Yuga x 4x US 519-6 4x Yuga x 4x US 519-6 4x Yuga x 4x US 520-2 4x Dulcet x 4x Dakota 4x Dulcet x 4x US 519-6 4x Dulcet x 4x US 520-2 4x Creek x 4x Loretto 4x Creek x 4x Loretto 4x Creek x 4x Dakota 4x Creek x 4x US 519-6		No fruit set. Note that the muscadine was the seed parent. Plants were severely damaged by 2-4-D when in full bloom.
1955	4x Niagara x 4x 11-178	0 9	on recently grafted plants in reenhouse.
1956 142 144 143 145 146 147	4x Niagara x 4x 11-178 4x Niagara x 4x 20-30 4x Niagara x 4x 6-4A 4x Campbell x 4x 11-178 4x Champanel x 4x 11-178 Champanel (4x) x 4x 20-30 4x Champanel x 4x 6-4A 4x Loretto x 4x 11-178	35 4 0 9 15 8 3	Later identified as being not hybrid and discarded.
1957	4x 520-2 x 4x 11-178 4x Loretto x 4x 11-178 4x Champanel x 4x 11-178 4x Black Rose x 4x 11-178 4x Thomas 4x 519-6	0 0 0 0	
	4x Yuga 4x Champanel 4x 520-6	} 0	
1958 178 179	4x Champanel x 4x 6-4A 4x Franklin x 4x 6-4A	2	0 1
	4x Loretto x 4x 6-4A 4x Niagara x 4x 6-4A 4x Franklin 7 x self	0 0	

etraploid Species Gresses

No fruit . Note that the ament, amscading was the seed gament, Plants yere severaly damaged by - 1- when in Inll closs.		Ax Thomas x Ax Loretto Ax Thomas x Ax Tehota Ax Thomas x Ax US 11- Ax Topsail x Ax US 519-6 Ax Yuga x Ax Loretto Ax Yuga x Ax Dakota Ax Yuga x Ax Dakota Ax Yuga x Ax US 519-6 Ax Taloet x Ax Topetho Ax Daloet x Ax Topetho Ax Daloet x Ax Topetho Ax Topek x Ax Topetho Ax Topek x Ax Topetho Ax Treek x Ax Topetho	1954
or recently grafted plants in greenhouse.		bx Ningara x 4x 11-178	
Later identified as being unt hybrid and carded.	32 0 8 5 8 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	**************************************	

The state of the s

Year & Cro	oss Parentage	Seed	Plants
1959 200 202	4x Franklin f x 4x 6-4A 4x Lake Emerald x 4x 6-4A 4x Champanel x 4x 6-4A 4x Loretto x 4x 6-4A 4x US 520-2 x 4x 6-4A 4x Vergennes x 4x 6-4A		25
299	4x Franklin x 4x NC 20-30 4x Franklin x 4x M7 4x US 3-7 x open	0 72 15 23	

226-13 x elf 20 (20 seed semt to Locais . 1961)

Table 22.

Diploid Species Crosses & Colchicine Treated

Year & Cross	Parentage		Plants Treated	Hybrid	Probably 4x
				a depart de principal de la companya de la company La companya de la co	
1957	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		2	77 •	
168	2 crosses bunch x muscadin			edling not	nybrid
169-173	6 crosses muscadine x bund	en	not	ybrid	
1958	seed from Dr. Dermen				
193	SV 14-287 x NC 60-60	26	15	0	
194	Seneca x M-15	28	13	2	2
195	Seneca x M56-8c	35	19	õ	~
196	US 519-28 x M 56-8c	190	92	35	9
197	US 519-28 x M 16	237	98	87	34
198	US 519-28 x M 15	192	64	21	13
180	Lutie x NC 60-60	19	5	0	
3.000					
1959	E-1-1-1-10 00 20		0	0	
219	Fredonia x NC 20-30	18	2	0	
220	Fredonia x NC 27-262	0	0	0	9 7 1
220	Fredonia x NC 60-60	92	5	1	? 1 weak
221	Niagara x NC 20-30	14		1	0
222	Niagara x NC 27-262	76	34	0	
223 224	Niagara x NC 60-60 Golden Muscat x NC 20-30	48 126	22	0 21	E
225	Golden Muscat x NC 27-262	99	43 28	11	5
226	Golden Muscat x NC 27-202	83	31	22	10
227	Lutie x NC 20-30	8	3	0	10
228	Lutie x NC 27-262	12	4	0	
229	Lutie x NC 60-60	10	1	1	
227	Concord x NC 20-30	0	_	T	
	Concord x NC 27-262	0			
230	Concord x NC 60-60	30	2	0	
231	SV 12-375 x NC 20-30	17	11	0	
232	SV 12-375 x NC 27-262	78	24	0	
233	SV 12-375 x NC 60-60	42	13	0	
~//	2 2 2 2 1 7 X 110 00-00	42	4.7		
1960					
294	Van Buren x NC 27-262	131			

yEdedomi .	h ind vid				
	1151	: ==		10 D	go control of management of the control of the cont
ot by brid	n gallbe			es wach's mucadir	169-173
				12	
		1.5	35	-	
	S		35		
	35			14/11/11/11	
				=-	
CI	Γ	Se		11-11-11	
				- (1	
		S	8.0	06-02 00 x	
				1)(
				onis x NO	
				ara x NC 20-30	
			76		
			87	- · OM x sq	
7			120	Muscat v NC 20-30	
			66	Museat x NC 27-262	
3					
	0	87			
		7		27-262	
				09-09 DM .	
				05-05 DW x 50	
				590-List x	
		S			
	0			08-00 NO x -	
				-	
		S.I.	4.2	00-00 W x -	

Van Buren x WC 27-262

+

Table 23.

Triploid Species Hybrids

Species Crosses to Obtain Triploids. Seedlings treated with colchicine to induce hexaploidy.

Year & Cross	Parentage		Plants Treated	Hybrid	Field	Probably Double
1959						The control of a college of the control of the cont
203	4x Franklin x 2n 20-30	326	21	21	15	4
212	4x Franklin x 2n 20-30	30	2	2	1	Ö
204	4x Franklin x 2n 27-262	246	14	13	10	2
211	4x Franklin x 2n 27-262	14	2	2	2	0
205	4x Franklin x 2n 60-60	145	51	51	49	4
206	4x Dakota x 2n 20-30	1	0			
207	4x Dakota x 2n 27-262	5	0			
209	4x Champanel x 2n 20-30	3	0			
210	4x Champanel x 2n 60-60	1	0			
213	2n Fredonia x 4x M6-4A	34	3	0		
214	2n Niagara x 4x M6-4A	24	3 5 1	0		
215	2n Concord x 4x M6-4A	25	1	0		
216	2n Golden Muscat x 4x M6-4A	61	12	0		
217	2n Lutie x Muscat x 4x M6-4A	32	7	0		
218	2n SV 12-375 x 4x M6-4A	32	17	0		
1960						
293	2n Golden Muscat x 4x NC 20- 2n Van Buren x 4n NC 20-30	30 82				

onectes rot to Obtain Iriologaths.

Probably Double	Mield	h tad vil	Plants Treated	à òead	
? 0 5 0 7	15 1 10 2 2 49	13 2 21 21 21 21	14 2 51 51 0 0 0		
			77 77 2		

Table 24.

List of Grape Material at N. C. Experiment Station, Raleigh, N. C. January 1, 1961

I Muscadine

1. Overhead Arbor A. Varieties

Scuppernong (Scott) Burgaw Hunt Dearing Scuppernong (Manteo) Luola Tarheel Magoon Thomas Dulcet Duplin Topsail Higgins Nevermiss Wallace Howard Onslow Yuga Meridian selections M7 M16 M36-2A M15 M17

B. Older numbered selections, breeding stock

B6-19 (Latham x Burgaw, Dearing) sib of Topsail

V21 R15 B2 (Latham seedling, Dearing) F. source of high sugar

G-52 (Thomas x Hope, Detjen) source of perfect-flower

25-2-26 (from Hope, Williams) F. productive, hancy flavor, light

37-10-1 (from Hope, Williams) productive, light, perfect flower

M45-90

, the to the property of the or the same

(dd.e ! monseques! (upd wh! macrosom re. fundre. freedo!)

Scale againment can like for the in

diiri, Bedete, F. earne of his sume source of carlest-ligen and proved of carlest-ligen and controlles light carefor to a

Remarks	Attractive, large, fair Fine flavor, productive, early	Fine flavor, even, dry scar, good foliage Loose cluster, sweet, mild, even?	ven (se ttracti	Good flavor, dry scar, even, good foliage Good, sweet, early, scar Good, very early 8/25 Late, good, foliage Good, attractive, cluster Very good, scar, sweet Very good, sweet, scar, M. early Good, attractive, scar, shiny, dots. Attractive, good Attractive, cluster, parent size Cluster, mild, productive Flavor, scar, foliage Flavor, sweet, scar, early Prod., sweet, mild, uneven, loose cluste
vadí blait	50	222	35	5 50 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
Sugar	Mississippi 65 16 60 18	0000	900	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
S Z S		T 4 5	200	44 WW W W W W W W W W W W W W W W W W W
Coron	M M M	mam	MB	E MES SEMBSEBBBB
Resistance	7 -1 17.	\$0 to 60	11	1011 10100100111
Productivity	Georgia	testir 7 7 7		0 10 0 0 C 10 10 10 00 00 00 00 00 00 00 00 00 00
Vigor	1 8 C			7077 7007000000
υ Θ 	- Tested Burgaw	- further Burgaw Tarheel	Burgaw 11-173	Burgaw G. 52 Ilarheel Burgaw Tarheel
L. CSelections from McCullers Selection Parentage	for release - Lucida Creswell	for increase Topsail Topsail	Lucida 25-8-26	food Topsail Latham Oreswell " V21 R15 B2 Howard Lucida Lucida Ccupp Topsail Latham "
Selection	Ready 27-262 29-193	Ready 9-305 11-173 11-186	27-128	Very 6 15-161 15-161 15-161 15-162 29-32 29-156 33-13 33-13 59-32 59-32 15-165 17-197
-	Contrie		Porter of the state of the stat	Sandy

Remarks	Prod., sweet, cluster - small Large, attractive Large, scar, more acid than 27-262 Good flavor, fair cluster Good flavor, sweet, scar, early Late, attractive, good cluster F	Prod., sweet, very cluster Attractive, large, poor flavor, parent Good parent for size. Fair, scar, foliage Attractive, pearl, acid, Parentage F Large, fair, source for size	Mild, insipid - (have 4x form) Sweet, even, shell, poor foliage Sweet, good, scar. Good, cluster, mild, chlorotic
.sdl blaiY	0404W8 0404W8	1 25 1 4 20	4 4 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
Sugar	HHHHHH 12000000000000000000000000000000000000	95599	20071
Size	820250	% 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	344 R
Toloo	Mana Mana Mana Mana Mana Mana Mana Mana	DESEED	
Resistance	4000000	0011100	0000
Productivity	000000	mp 0 9m	nono
Togiv	110011	0000000	0000
ů.	Tarheel Burgaw " " 11-173	Tarbeel Wallace George	Tarheel " Burgaw
Parentage	Thomas Lucida Creswell V21 R15 B2	Thomas Lucida Scupp 25-2-2 Beula F1	Probable discard 8 Topsail Latham V21 R15 B2 Scupp
Selection	20-30 27-229 27-354 29-47 33-106 58-89F	Stock 20-119 28-193 28-222 44-47 46-15F 64-53	Proba 11-178 17-55 33-9 56-98

TABLES (TITA SOUTH TO STOR ENGLANCE ENG Cost person for size. The formal expects

W	
ord	
-	
-	
0	02
54	5
E-1	0
	01
1	4
त्त	0
0	0
old	[
40	0
Sa	W)
0	
>	
	Ti
	, ,

																		9/1 per										
Remarks			Cluster, early, sweet, flavor, persist.	. V. good, follage	cluster	TVe, p	cluster, good, soft, persist	V. good, cluster, foli	t, good, foliage	luster, even, good,	>	active, sweet, good, scar	good, even, cluster		cer, even, good, attra	7 8/2		ustered, good, even, dull, early	, good, even, soft	good,	Weet, large, F	57		good, persist.	large, good	good, even,	ter, attractive,	et, soft, goo
	Sugar		100	100	100	17.5	100	797	20	10	19	00		10	00	60		00	00 H	00	7		77	17	16	91	17	19
	S E S		43	97	20	25	47	52	45	50	20	69	35	9	1.7	87		07	20	42	59	20	42	300	65	50	52	26
	Color		m	<u>m</u>	15		100	Daniel Street	2	pa	N	N	2	m	M	3		pq	m	m	FA	£	m	pa	m	-5	Personal Property of the Party	75
	Resistance		00	00	00	00	1	00	-	00	00	7	00	7	60	00		60	co	00	00	00	7	7	00	0	-	-
	Productivity		100	9	00	00	1	7	7	7	0	9	7	7	00	-		00	7	00	20	7	00	0	00	0	00	7
	ATEOR		₹	60	00	7	to	C.	0	-	7	-	00	00	00	_		0	00	2	60	9	700	7	7	000		tio)
	φ 20		20-119	den den	11-178	17-197	17-123	28-193	Open days	29-67	1. 4, mak ??	silvar direc	42-232	min den	37-10-1	17-123		20-119	liter tros	fine fine	Store etc. St	17-197	do-	865	Byens Other	11-178	Tearing	33-23
suc	Parentage		Latham	Garan dawa	Stuckey	Nevermiss	gen. Mass	Topsail	6 11	43-123	Topsail	den	gan gan	Notice diliper	dino dino	25-8-26	8000	Latham	MAD DOS	direct direct	=	Thomas	itino itino	***	ф ф	Stuckey	are i	
A. Selections	Selection	Best	77-21	77-61	87-47	85-172	8612	0,400	88-102	104-8	108-109	108-169	109-21	109-157	110-34	115-180	ery		11/-108	777-194	77-123正	477-08	80-114	80-153	80-169F	81-16	3-52	95-78
,								(Day.																			

ersist.

Remarks	Sweet, good, even, scar Cluster, sweet, fair Good, sweet, sub acid, cluster Good, sweet, sub acid, cluster Sweet, Cluster, uneven F Cluster, sweet, good, late Sweet, good, oval, persist Sweet, good, scar, foliage, soft Cluster, attractive, pink, sweet, mild Sweet, soft Very cluster, very prod, good Large, attractive, fair Large, attractive, acid, low flavor Good flavor, good foliage, sub acid Sweet, even sub acid, persist, M. early Sweet, good, even, scar, persist, M. early
Sugar	11111111111111111111111111111111111111
o s	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Productive Resistance Color	SEMPLE SEMPLE SERVICE
Vigor	7 7 3 3 3 4 7 3 5 5 7 6 5 7 6 5 7 6 5 7 6 7 6 7 6 7 6 7
a	33-23 17-197 17-197 20-40 20-40 9-308 29-156 42-232 29-156 60-60 Duplin
d) Parentage	Stuckey Nevermiss "" Topsail 15-165 46-7 44-88 45-40 Topsail "" 25-8-26 50-55 Topsail Hunt Turkey Thomas Stuckey
. (continued	84-92 85-122 86-122 86-122 87-56F 87-56F 89-12 89-12 89-12 103-35 109-34 109-12

Remarks	ctive, fair, uneven folctive, fair, large h, attractive, poor, pur h, attractive, poor, pur h, attractive, good sub acid cluster, good, late cluster, good, late cluster, good, fair, pe purple, fair, shell er, sweet, mild F imild, good er, melting flesh er, very melting flesh er, very melting flesh er, very melting sood er, melting, early foliage, fair	Umplin x Sell) Solt, acid, Ialr Large, sub acid, fair Attractive, sub acid, good
Sugar	00000000000000000000000000000000000000	
Ω' "∐ ©	00000000000000000000000000000000000000	U W W
Color	EMPEREZZE ZZZZZZZZZZZZZZZ	3 3 3
Resistance		0 = 00
Productivity	17001000000 00100001000111	-1-1-
TogiV.	3746747674 67466666666666666666666666666	- 1- 100
0	28-193 28-222 27-29 27-29 27-29 27-29 27-29 27-29 27-29 27-29 27-29 27-29 28-222 17-197 5-106 48-2-1	27 - 229
ed) Parentage	Topsail 46-7 Topsail Latham Latham Latham Latham Topsail Hunt Nevermiss 19-125 Scupp	46-7
A. (contimued Selection	88-67 88-120 100-8 100-8 100-29 100-29 100-29 110-93 111-113 111-108 111-47 111-13 111-13 111-13 115-259 115-259 115-146F 115-146F 115-146F 115-146F 115-165 115-165 12-109 13-90 13-90 13-90 13-165 10-165 1	101-35

2. B. Seedlings Planted

	Lucida x Tarheel - Cross made to study inheritance of fruit size, and linkage with sex. 200 fruited, 8 selected in 1960. Medium size, thinner skin, mild, fair cluster.	Topsail x 60-60 - Cross for large attractive, sweet, light color, - Total 122. Started fruiting in 1960. Weak, pistillate, susceptible and small fruited discarded. 22 saved, many with fine flavor & attractive.	Topsail x 56-98 - Cross for sweet, good, light color. 40 seedlings. Most discarded in 1960. Black ones cannot be of cross.	Topsail x 16-21 - Cross of Topsail x vigorous, very resistant vine. Total 18 seedlings. 3 left.	Hunt x 60-60 - Cross for better quality Hunt. Total 107 seedlings. Reduced to 28. Should be some good seedlings.	Hunt x 68-14 - Quality & cluster. 189 seedlings reduced to 16. Bad foliage from black rot.	Hunt x 69-60 - Quality & cluster. Seedlings total 109. Weak and pistillatediscarded.	Hunt x 44-15 - Cross of 2 good blacks. 14 reduced to 2	Thomas $(4x) \times 47-9B (4x)$ Thomas $(4x) \times 20-30 (4x)$ Topsail $(4x) \times 47-9B (4x)$ Scupp $(4x) \times 11-178 (4x)$
No. Seedlings	60	22	C×	C-1	23	16	77	<i>t-q</i>	0 \ = 0 \ \ \
Cross	148	150	7	152	22	154	70	150	11000

A THE PROPERTY.

ුගරේවර එරැයුර්ට දුර්පටමු ප්රාමාශ වැනී ම මුතු පුර එමානයක කොල කිලුමේමි .

erette Mil . of beorge syntimes 285 . Totalis & Stient - Jies a total

S of Esculies II. SE HOOM S TO SHARD - T - F THE

A Booking It. - States No. 1 Section (St.) Section (St.) Section (St.) Section (St.)

resaute aid (applicat)

THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAM

2.B. (continued)

Seedlings

Cross

Lucla might be the parent of Topsail Size x quality Size x quality Two good whites, cluster Two good whites, cluster For comparison with similar cross at /x le For soft pulp & quality For soft pulp & quality
Inola x 60-60 Inola x Burgaw Higgins x 29-193 Higgins x 60-60 45-15 x 29-32 58-89 x 29-32 Yuga x Dearing Duplin self x 29-47 Duplin self x 29-32
H 00 00 00 2 2 0 1 0
1182 1182 1188 1188 1188 1188

evel

Crosses 159 -- 190. Bad luck all thru. The year I had flu in May.



2. C. Seedlings in nursery rows - Crosses of 1959

Tetraploid

234 237 238 239 240 241 242 243 244 245 247 248 249	5	Parentage Higgins (4x) x NO 20-30 (4x) Yuga (4x) x NC 20-30 (4x) Yuga (4x) x NC 20-30 (4x) Yuga (4x) x M6-4A (4x) Yuga (4x) x M51-9E (4x) Yuga (4x) x M47-9B (4x) Topsail (4x) x NC 20-30 (4x) Topsail (4x) x M51-9B (4x) Topsail (4x) x M47-9B (4x) Topsail (4x) x M47-9B (4x) Topsail (4x) x M6-4A (4x) Thomas (4x) x M6-4A (4x) Thomas (4x) x M51-9B (4x) Thomas (4x) x M51-9B (4x)		
251 252 253 254 255 256 257 261 262	Triploid 2 11 7 9 6 4 3 3 9	& colchicine treated Higgins (4x) x NC 87-100 (Lucida (4x) x NC 87-100 (2 Lucida (2n) x NC 109-34 (2 Yuga (4x) x NC 20-30 (2n) Yuga (4x) x NC 87-100 (2n) Yuga (4x) x NC 109-34 (2n) Topsail (4x) x NC 20-30 (2 Creek (4x) x NC 87-100 (2n) Creek (4x) x NC 109-34 (2n)	2n) n) n)	2 + 3? 2n Arm on Lucida 4x
271 272 273 274 275 276 277 278 279	Diploid 109 202 38 244 137 146 54 115 85	87-56 x 111-108 80-169 x 95-167 87-126 x Duplin S127 92-9 x 109-21 Topsail x 111-108 Higgins x 88-102 87-126 x 59-32 58-89 x 109-120 58-89 x 111-108	Size Swee Yield Qual: Size Swee Late	, cluster, flavor x cluster , cluster, flavor x acid & soft t, tender, size x soft pulp d, sugar, small x size, sugar ity x cluster x cluster, size, flavor t, tender, cluster x attractive , quality x flavor, sugar , quality x cluster

2. D. Seed sown February 6, 1961 - 1960 crosses

Cross	Seed	Parentage	
280 281 282	75 200 200	77-123 x 108-109 80-68 x 95-162 80-169 x 109-157	Cluster, size, flavor x size, attractive & sugar Cluster, flavor, size x acidity, soft Cluster, flavor, size x even, flavor
283	57	87-56 x 108-109	Size, sugar x size, sugar, attractive
284	107	87-126 x 109-21 100-29 x 84-92	Sugar, cluster, tender x sugar, cluster, flavor Size, no flavor x size, sugar
286	29	112-54 x 108-169	Size, sugar x size, flavor, attractive
287	45	115-38 x 77-21 115-121 x 29-193	Cluster, size x cluster, flavor Cluster, size x quality
289	250 300	115-146 x 109-21	Cluster, size x quarroy even, flavor
290	600	58-89 x 110-34	Quality, late x cluster
291	70	Topsail x 95-167	Sugar, quality x acid, soft
292	70	Latham x 111-108	Sugar x cluster

To use in crosses pistillate vines saved before discarding most of them.

2. E. Tetraploid Muscadine Selections

Plants	Parentage	Selection Symbol
2 1 1 1 1	NC 11-178 (4x) x self NC 20-30 (4x) x open NC 17-123 (4x) x open M6-4A (4x) x open Dulcet (4x) x open	
9	Creek (4x) x open	C47, C57, C62, C72, C79 C90, C98, C102, C105
3	Creek (4x) x NC 20-30 (4x) Thomas (2n) x NC 11-178 (4x) (also 3 propagations of 134-8	131-1, 131-5, 131-12 134-8 (3x)

Indone no trosist

orn and anthing of a color of the color of a color of a

January 1, 1961

II Species Hybridization

٨	Panantal	material
 A	1 07 011 000	THOUGHT TOT

-			
a.	4x bunch grapes		
	Lake Emerald	Niagara	Compbell
	Franklin	Dakota	Vergennes
	Champanel	Loretto	US 520-2
b.	2n bunch grapes at Cl	ayton	
	Stuben	S 9110	S.V. 12-375
	Golden Muscat	S 8357	S.V. 12-303
	Buffaloe		
C.	original colchiploids	s (4x)	
	Thomas	Scuppernong	NC 20-30
	Topsail	Dearing	M 7
	Yuga	Lucida	M 6-4A
	Creek	Higgins	M 14-5A
	Dulcet	NC 11-173	M 47-9B
	Hunt	NC 17-123	M 51-9B
	Dallas	NC 17-197	

Species-hybrid selections 9. B.

Vinifera-Rotundifolia

NC 6-15 (2n), NC 6-15 (4x), NC 6-16 (4x), B4-5(2n) Derived from (a) by Dunstan

b.

D56. DRX 55, D2 NC selections of NC 6-15 (2n) x open C. 615-1, 615-3, 615-5, 615-8, 615-9, 615-10, 615-11

d. US selections of (Franklin x Dearing)

US 3-1, US 3-2, US 3-3, US 3-4, US 3-5, US 3-6, US 3-7, US 3-9

(New) Golden Muscat x NC 60-60 NC 226-11

b c. Species-hybrid seedlings (not colchicine treated)

1400 -10	and the state of	and the second	
Year	Cross	Plants	Parentage
1957	177	4	NC 6-15 (4x) x open
1958	191	129	NC 6-15 (4x) x open
1958	192	7	NC 6-15 (4x) x NC 6-16 (4x)
1959	266	24	NC 615-1 (2n) x open
1959	267	38	NC 615-5 (2n) x open
1959	268	26	NC 615-8 (2n) x open
1959	269	16	NC 615-10 (2n) x open
1959	270	96	NC 615-11 (2n) x open
1959	200	20	Franklin (4x) x M6-4A (4x) 1959 nursery
1959	202	5	Franklin (4x) x M6-4A (4x) 1959 nursery

.

Consider the second of the sec

(not alleniefne breated)

. D. 2n Species hybrid seedlings (colchicine treated)

1958 Cross	Number	Parentage	Probably Doubled
194 196 197 198	2 35 87 21	Seneca x M 15 US 519-28 x M 56-80 US 519-28 x M 16 US 519-28 x M 15	2 9 34 13
1959 220 221 224 225 226 229	1 21 11 22 1	Fredonia x NC 60-60 Niagara x NC 20-30 Golden Muscat x NC 20-30 Golden Muscat x NC 27-262 Golden Muscat x NC 60-60 Lutie x NC 60-60	1 ? 0 5 3 10

(The above will need cutting back and selecting in 1961. Many should flower. Several good 2n hybrids. Among the 1959 seedlings more 4x should be found in 1961.)

1. E. 3x Species hybrids, (Colchicine treated)

1959				
203	15	Franklin (4x) x	NC 20-30 (2n)	4
212	1	ditto		0
204	10	Franklin (4x) x	NC 27-262 (2n)	2
211	2	ditto		0
205	49	Franklin (4x) x	NC 60-60 (2n)	1

7. E. Crosses of 1960, seed planted 2/6/61

•	0100000	OT 1700, 20	eed pranted 2,0,01
	Cross	Seed	Parentage
	293 294 295 296 297	82 131 17 200 150	Golden Muscat (2n) x NC 20-30 (4x) Van Buren (2n) x NC 27-262 (2n) Van Buren (2n) x self (for comparison) Van Buren (2n) x open (for comparison) Golden Muscat x open (for comparison)
	298	72	Franklin (4x) x NC 20-30 (4x)
	299	15	Franklin $(4x) \times M 7 (4x)$
	300 301	31 21	NC 6-15 $(4x)$ x open NC 6-15 $(4x)$ x NC 6-16 $(4x)$
	302	6	NC 6-15 $(4x)$ x Champanel $(4x)$
	303	2	NC 6-15 (4x) x US 520-2 (4x)
	304	45	NC 6-16 (4x) x open
	305 306	16	NC 6-16 (4x) x self NC 6-16 (4x) x Champanel (4x)
	307	314	NC 6-16 (4x) x US 520-2 (4x)
	308	23	US 3-7 (4x) x open = (Franklin 4x x Dearing 4x)
	309	63	NC 615-1 (2n) x NC 77-51 (2n)
	310	32 33	NC 615-5 (2n) x NC 77-51 (2n) NC 615-8 (2n) x NC 77-51 (2n)
	312	34	NC 615-5 (2n) x NC 615-11 (2n)
	313	31	NC 615-11 (2n) x self
	314	20	NC 226-11 (4x) self = (Golden Muscat x NC 60-60)

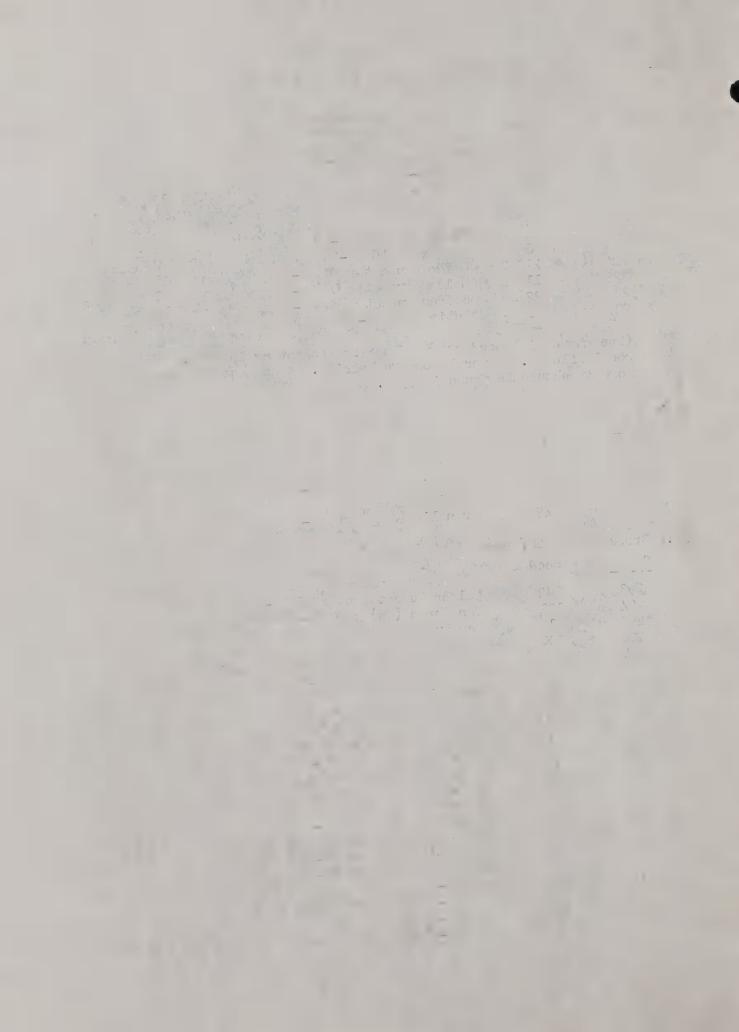
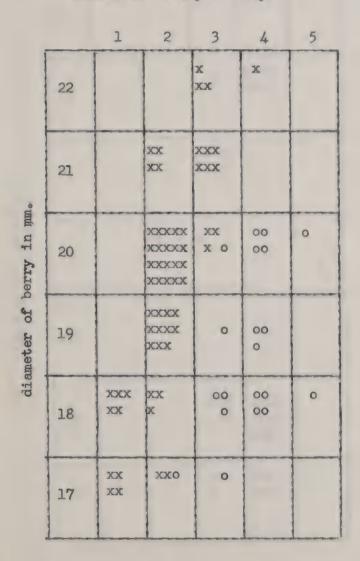


Figure 1. Comparison of size of berry of 2n and 4x vines in relation to the number of seed per berry

x = tetraploid
o = diploid

Number of berries classified by number of seed per berry



NC 11-178

on Equatod to a so bin for to a co

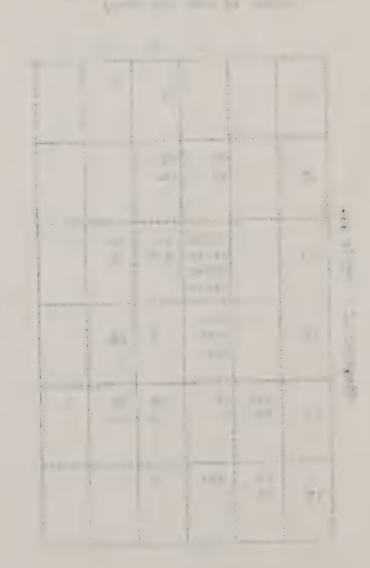


Figure 2. Comparison of size of berry of 2n and 4x vines in relation to the number of seed per berry (continued)

x = tetraploid 0 = diploid

Number of berries classified by number of seed per berry

		1	2	3	4	5
	24			х	xx xx	
	23				XXXXX	
in mu•	22		х	XXXXXX	х	
diameter of berry in mm.	21		жx	x		
diamete	20					
	19			000	0000	
	18			00	000	

NC 20-30

In and Ax vines relation (combined)

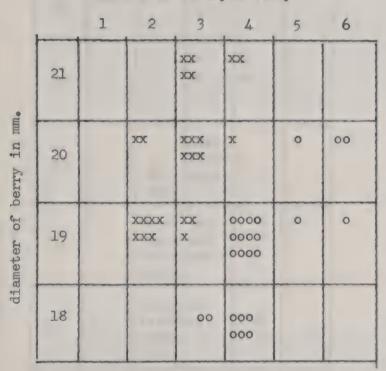
umber of berries olsesified by



Figure 3. Comparison of size of berry of 2n and 4x vines in relation to the number of seed per berry (continued

x = tetraploid o = diploid

Number of berries classified by number of seed per berry



M7

sure 3. Companison of size of berry of 2m and Ax vines in relation to the number of sead our berry (sortinged

x = totraploid o = diploid

Amber of berries classified by muber of seed per berry

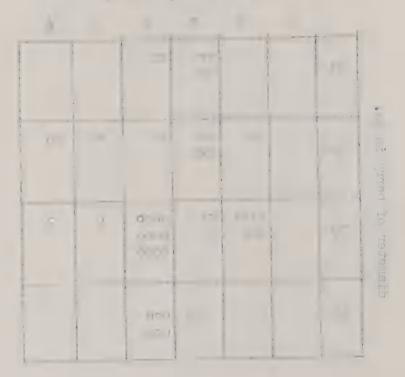


Figure 4. Comparison of size of berry of 2n and 4x vines in relation to the number of seed per berry (continued)

x = tetraploid
o = diploid

Number of berries classified by number of seed per berry

		1	2	3	4	5
24	+			OCX.		
23	3		x	xx xx	XXX	
2:	2		xxx	XXXXX	x	
2:	1		XXXXXX XXXXXX	XXXX	x	
20		x	XXXXXX XXXXXX XXXXXX	XX	жо	
19		xx x	XXXX	х	0000	
18			xxo	000	00000	
17		хх	х	00	000	
16		х				

diameter of berry in mm.

MIO

144.23 1 - 10 -



1. NC 111-108 Latham x (Lucida x Burgaw) Light fruited selection with large clusters of persistent berries. Clusters with desirable long stems.



2. NC 94-4 (Thomas x Burgaw) x (Scuppernong x Tarheel) Dark fruited selection with large compact clusters. Vine is very productive, but the fruit is rather acid.



3. NC 60-60 25-8-26 x (Topsail x Tarheel) Light fruited selection, with large fine flavored fruit.



4. NC 59-32 Lucida x (Topsail x Tarheel) Light fruited selection with large, very attractive berries.

Magazina

Poster

reef ored fruit.

skilling attended to the



5. NC 89-48 (Scuppernong x Tarheel) x (Topsail x Burgaw) Very productive, light fruited selection. Berries attractive and fine flavored.



6. NC 93-26 (Latham x Burgaw) x (Thomas x Tarheel) Very productive, black fruited selection. Clusters too compact and short stemed for easy harvesting. Sweet and good flavored.

A STATE OF THE PARTY OF THE PAR



7. Creek (4x) Original colchiploid vine showing very good vigor, equal to that of the diploid form. Canes are of the past season, unpruned.



8. Dulcet (4x) Original colchiploid showing severe dwarfing. Vine is the same age as Creek vine in Figure 7. Photo taken from shorter distance and the vine appears proportionally larger than it is in comparison with Creek. Canes show several years of growth.





9. Berries of 2n (left), and 4x (right) of NC 20-30, showing difference in size.



10. Two year old seedlings of 4x (left) and 2n (right). Note the short compact root systems and short internodes of the 4x seedlings.

. 11 And the second state of the second se



11. One year old seedlings of 2n crosses (left) and 4x crosses (right).



12. Two year old seedlings of 4x crosses (left) and 2n crosses (right).

. (x crosses (right), ...



13. NC 6-15 (2n) Many of the canes on this vine were winter injured.



14. NC 615-11 (2n). Seedling from open pollination of NC 6-15 (probably by V. rotundifolia). This seedling is perfect-flowered, fertile, and has a relatively large flower cluster.

this vine were winter injure.



15. Row of colchicine treated species hybrids. Cross of 1958, treated 1959, photo September, 1960.



16. Species-hybrids treated with colchicine.





17. NC 226-11 (4x) (Golden Muscat x NC 60-60). Cluster on colchicine treated species-hybrid, first year from seed. Cluster of 32 berries, averaging 3.8 grams each, 22.5% total soluble solids, excellent flavor.





18. Picking frame for harvesting grapes from overhead arbor. Fruit can also be placed directly into containers set on frame.



19. Picking frame for harvesting. Berries can be graded and packed as they roll out.

Ficking frame for harvesting grapes from overhead arbor. Fruit can also be placed directly into containers set on frame.

EDGE VYORTH BONG VALLEY PAPER OF

